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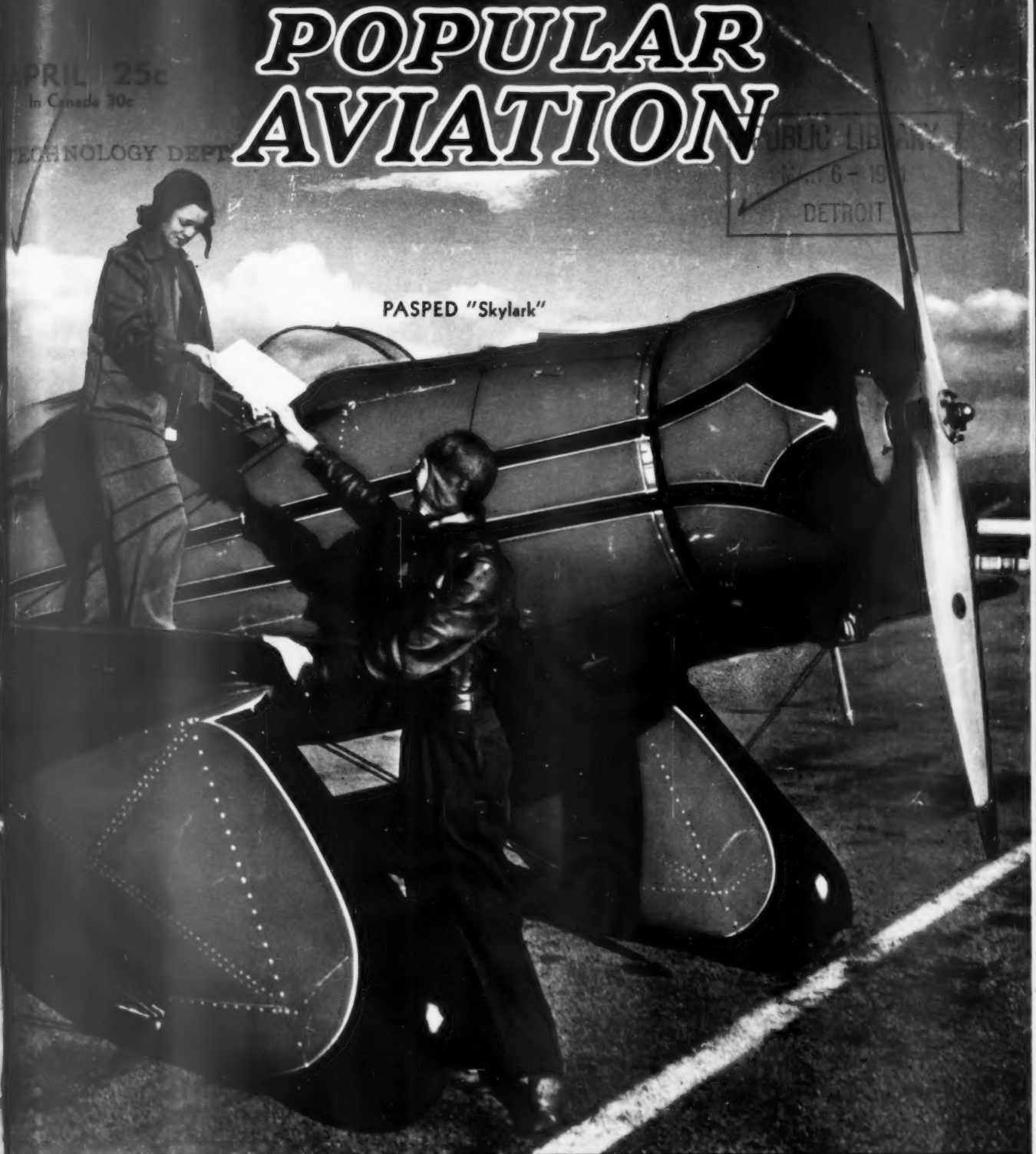


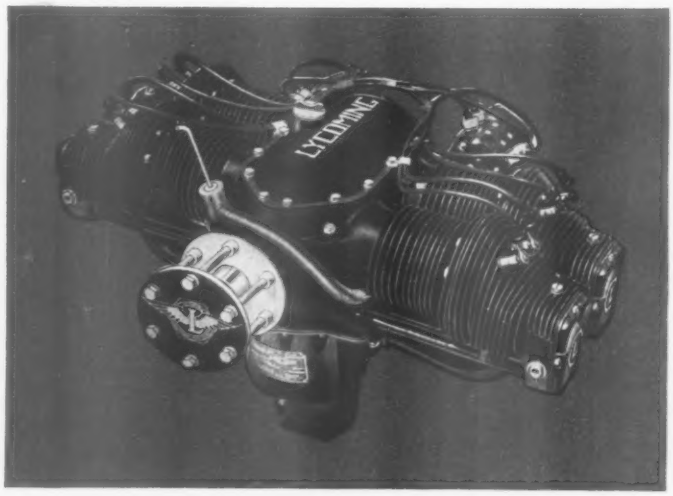
BRITAIN'S AERIAL OUTPOST

PILOTS-MASS PRODUCTION ★ *Latest Air War Photos*

IN *Sales!*

50 to 65 H.P.

Lycoming 50 to 65-horsepower engines achieved FIRST PLACE in light-plane engine sales for 1940. The preference for these "stars of the skyways" in America's civilian training planes marks a growing appreciation of the Lycoming BLUE RIBBON engine's amazing economy and unfaltering reliability . . . the same championship characteristics which have long made Lycoming radials a favorite in the training planes of America's armed forces.



STARS OF THE SKYWAYS

Illustrated is the Lycoming 65-horsepower engine. Other four-cylinder models are available in 50, 55, 75, 100 and 125 horsepower and six-cylinder models in 150 and 175 horsepower. They are all horizontally opposed and air cooled with provision for mechanical or electric starter and accessory drives.

FREE LITERATURE

on Lycoming 50 to 75-horsepower light-plane engines may be obtained from all Aeronca, Funk, Luscombe, Piper, Porterfield and Taylorcraft dealers. Or write Lycoming Division, Dept. P41, Aviation Manufacturing Corp., Williamsport, Penna., U.S.A. . . . Cable address: Aviatcor.

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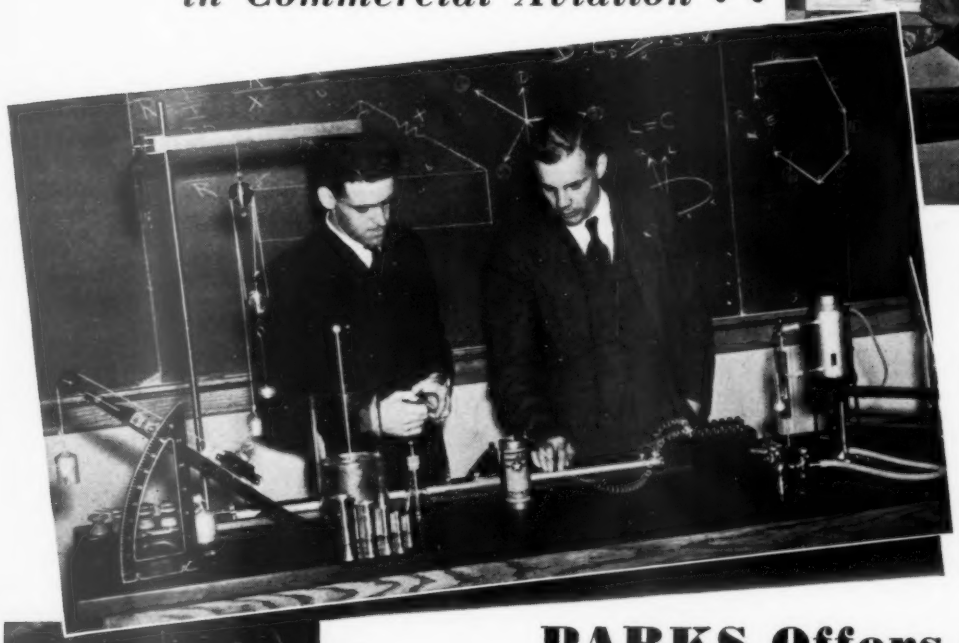

Above — *Public Speaking is an important part of background training.*

Left — *The how and why is demonstrated in the Parks physics laboratory.*

Aeronautical Engineering students have helped design and develop the Parks wind tunnel.

Engineering Drawing develops skill in graphical presentation of engineering data.

PARKS Offers a COLLEGE EDUCATION Majoring in Aviation

How far do you want to go in commercial aviation? If, in planning your preparation and training, you are looking several years beyond that first job—then consider carefully this important fact:

> Technical skill alone is not enough to qualify you for advancement to positions of leadership in commercial aviation.

Executives in commercial aviation—those who direct the work of many others—must know *why* as well as *how*. Executives must be able to apply fundamentals to new problems—to think straight through a problem to its solution.

That's why Parks courses provide a complete college education majoring in aviation — executive training including a broad educational background in addition to essential technical skills. So thorough are Parks courses that a recent national magazine article called Parks "The Harvard of the Air."

Proof that Parks training does equip men for advancement to positions of leadership is found in the steady demand for Parks graduates and the positions in which you'll find Parks trained men — chief engineer, chief meteorologist, chief pilot, captain, first flight officer, traffic manager, factory manager, service manager, department heads, and many others.

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PARKS AIR COLLEGE was founded August 1, 1927.

Has enjoyed full Federal approval longer than any other aviation school.

Is accredited in its Aeronautical Engineering School by the Illinois Superintendent of Public Instruction.

Is accredited by the United States Office of Education of the Federal Security Agency.

Graduates are qualified educationally for appointment as flying cadets in the U. S. Army Air Corps and for flight training in the U. S. Naval Air Reserve.

Has a capacity enrollment of 300 commercial aviation students, 216 U. S. Army Air Corps flying cadets and 48 enlisted mechanics.

Has its own airport with a school plant of 25 buildings devoted to school purposes entirely, also two fields of 568 acres and 96 acres for military flight training.

Has a faculty of 82, each especially qualified for his particular field of instruction.

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PARKS AIR COLLEGE East St. Louis, Illinois

ANY curtailment of private flying, national emergency or not, will be a dangerous blow to this country's security in the air. The Army and Navy can and should work with the private flyer, not against him. Talk of private aircraft being used by an enemy to bomb vital factories sounds more like Hollywood than Washington. Then, too, fears, that enemy agents might use private aircraft to skip across the Mexican or Canadian borders are stretching things a bit. Obvious answer is that, in the first place, a person must be an American citizen to get a pilot or plane license in the United States. Second, with the name and address of every pilot in the country on file in Washington, it is a simple matter to check up on each flyer and revoke the licenses of those deemed questionable by the Government. There are about 300 C. A. A. inspectors throughout the country, each of whom is thoroughly familiar with, and could submit complete reports on, every plane and pilot in his area.

Our 65,000 civilian airmen—as well as the 17,000 civil aircraft now in use in this country—comprise the largest potential utility air force on earth. Rather than curtail this immense army of flyers, the military services should do everything possible to encourage other air-minded young men to take up flying.

How can all these pilots help the military services? What good are slow, light sport planes in a country at war? It doesn't take much imagination to see the answer. Private pilots, flying their own ships, could immediately establish the most widespread high-speed courier service ever to be connected with any army anywhere in the world. The Army Air Corps, of course, intends having such a branch of its service—but why use valuable, elaborately-trained military pilots to do a job a *Cub* pilot could handle? Then, too, private flyers and their planes could be used to keep up a constant coast-to-coast transportation system for Army or Navy personnel or equipment—releasing, again, trained military airmen to other more specialized duties. It is even conceivable that civil pilots and planes could release many veteran pilots by carrying certain air mail. Or large numbers of radio-equipped sport planes could immediately set up a gigantic aerial patrol network, literally covering every foot of all four sides of the United States. There are myriad other duties that logically could be handled by civilian flyers: aerial photography, ferrying of new military aircraft and ambulance work. All our Army and Navy need do is set up the system that will utilize all available types

(*Continued on page* 88)

FLYING
AND POPULAR AVIATION

Volume XXVIII Number 4

Contents

APRIL, 1941

Dive Bomber	Ensign Seymour Kail	14
Air Depot		17
The War to Date		18
Ground School—Minus Books	John R. Hoyt	22
Paratroops		25
Phenomenal Flivver	John C. A. Watkins	26
Pilots—Mass Production	Heinrich Haupt	28
High Babes	E. Jay Doherty	31
Britain's Aerial Outpost	James Bassett, Jr.	32
Hornets' Nest	Alma Heflin	35
Are Army Flying Cadet Standards Too Severe?	Bishop and Lambert	36
The Ladies Do the Work	Helen Waterhouse	38
Gyro Guide	William P. Lear	40
Ultra-High for the Future	DeWitt Wendell	42
All-Out Dead Reckoning	Lieut. T. C. Gillmer	43
I Learned About Flying From That!—No. 23	Gus Doppes	45
Mountain Flyer	J. Clarence Moore	46
The Bush Flyers Carry On	Morton L. Bennet	48
Want a Job?	Hurd Barrett	49
You Don't Say!		49
Data Book		51
Calculation of Range	Raoul J. Hoffman	53
Have You Seen?		54

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14
17
18
22
25
26
28
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You, who plan to invest in a course of career training to prepare yourself for the future, must determine in advance what the returns will be on your investment before you put cash on the line. This is imperative since your choice of a school in which to take your training will determine how much money you will make all the rest of your life. Your whole future in aviation depends on your training.

Curtiss-Wright Tec's career training is carefully designed to do just one thing:—TO MAKE MORE MONEY FOR YOU so upon graduation you can be independent and self-supporting for life. For years our hundreds of successful graduates have proven that Curtiss-Wright Tec training gets results and always pays. It has provided them with a profitable occupation and secure future since it trained them in advance for the highest position they could ever expect to occupy. It can do the same for you.

Aviation needs trained men. They are in demand and at a premium. Advancements for them are rapid, especially here in Southern California where there are over a billion dollars in unfilled aircraft orders on hand and where over fifty per cent of all aircraft manufactured in the United States is made. You can get in on the ground floor by training now, BUT you must choose the right school for your training.

Our graduates are obtaining immediate employment and the demand for them far exceeds the supply. We honestly believe that every student who enrolls here will be able to obtain, with our assistance, immediate employment upon graduation. This school has never guaranteed or promised positions for its graduates, but practically every graduate has obtained immediate employment, and is advancing steadily.

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The Birdmen's Perch

What goes on here, anyway? On this page, gentlemen, *we* print the puzzles—*you* solve them. I'm making a point of this because a lot of you readers of the Perch have been sending me problems and puzzles. Dandy ones, too. Only you don't send the answers with them. And how can I publish them in the Perch if I'm not sure of the right answers myself? Work 'em all out? Have a heart, fellows, and send answers with all puzzles!

Major Al Williams, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

WOOING THE MUSE DEPT.

Thurman DuVall, a R.W. from Georgia Tech, thinks so much of Gulf Aviation Gasoline that he is moved to poetry. The following little epic, entitled, "G's," is reprinted with the kind permission of the author:

I think that I shall never see,
A gas as good as G.A.G.
A fuel that gives its very best
To fly these "birds" that have
no "nest"
A gas that's tops in many ways,
Used in every "crate" these days
Planes are flown by guys like me,
But only Gulf makes G.A.G.!

DISHWASHING—A TO Z.

When it comes to washing dishes, there seems to be a number of different schools of thought. For instance, there is the bachelor, or let-them-pile-up-to-the-ceil-

ing school. The bachelor grasps the dish and holds it under the hot water tap for a moment. He then lets the towel do most of the dirty work. Then there's the "sudsy" school. These folks believe in plenty of soap. They get the plates pretty clean—but the next time you use them there's liable to be a distinct flavor of soap. Of course, the ultimate in dish-washing is one of those new machines that does everything but stack the dishes for you after it's through washing them. What a job those machines do!

Washing dishes and cleaning up an oil have a lot in common. (Refining oil is really a cleaning process). There are lots of different ways to refine an oil. But you'll be glad to learn that Gulfpride is refined by the finest of these processes—the Alchlor Process. Like using a modern washing machine instead of the hot water tap—it does the job of "cleaning up" better. In fact, it removes up to 20% more impurities. That's the simplest explanation of why airmen find it does such a wonderful job—year in and year out—in their motors.

ALL SLIDE RULES BARRED!

Max J. Conklin, of Lansing, Michigan, sends us this little brain-addler. He's one of the people who *did* send the answer. We have it and for the price of a post-card and a few moments of your valuable time figuring this one out, we'll let you know what the answer is.

A heavily laden pursuit plane takes off from a given point and is so slow getting started that he averages only 90 M.P.H. for the first mile.

How fast would he have to go the second mile to average 180 M.P.H. for the two miles?

Send in your answers, boys, and don't try this in your own plane!

THIS MONTH'S WHOPPER

Dear Major,

Inasmuch as you are already being sued for $769.68 (see Nov. Whopper,) I would like to file notice of suit for the sum of $10,000,000.00. It all started like this:

I was flying from St. Louis to Chicago in my little forty-horse Cub, when I hit a Degonic line, (a line on the Earth's surface connecting points of equal deviation.) It must have thrown me off my course because I noticed that my gasoline supply was getting low, and no sight of Chicago. I also hadn't hit any of my check points during the last six hours (you can see that I use dead pilotage) and I was really getting a little bit concerned, when the motor started to sputter and cough and finally died altogether. I quickly spotted a farmer's field and made a nice dead-stick landing in a corn field. The farmer came out raving mad, but I offered to pay for the damages, and his anger rapidly faded.

I explained my predicament, and, gentleman that he was, he offered to let me have some Gulf Aviation Gasoline, which he kept

on hand to kill corn-borers.

I allowed him to put two gallons in the tank, and after starting the little motor first pull, I taxied back for the take-off.

Waving good-by to the farmer, I gave her the gas and thereby started this whole mess. The G.A.G. turned that little forty-horse power motor over so fast that the prop-wash started a tornado that wiped out three counties in Southern Illinois before they got it stopped.

The damage was estimated at $10,000,-000.00 which I honestly believe is conservative, and they're suing *me*, so I'm suing *you*.

Honestly,

NORMAN P. BALLESTER

Evanston, Ill.

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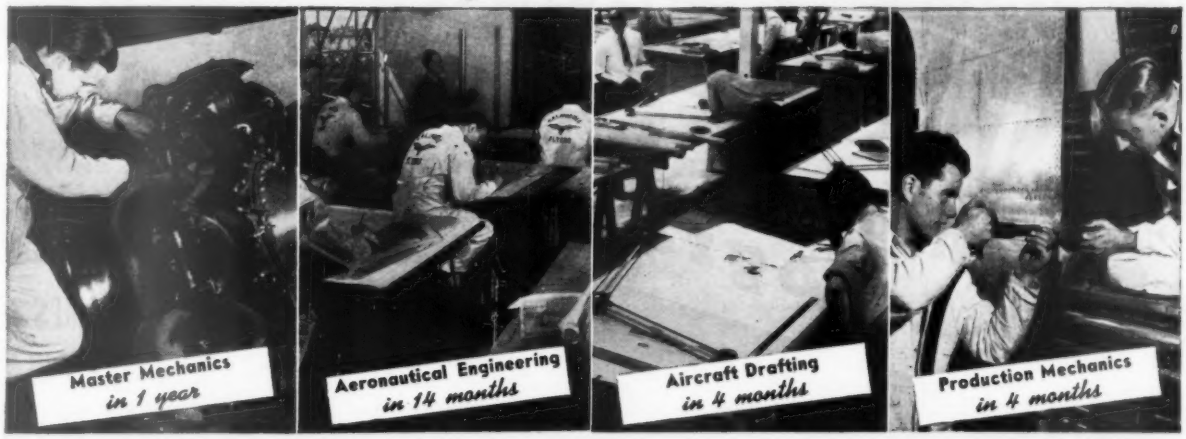

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Why does a California Flyers man stand so high? It is obvious once you have heard the complete story of this famous school. Its founders believe that aviation should be taught in a school where the student remained an individual—learning aviation as it pertains to his individual ambitions and qualifications, and by so doing preparing *him* for the responsibilities of leadership. This way the graduate is prepared to meet today's aviation problems and to contribute to tomorrow's aviation advancement. This is the way today's leaders learned. Only this way can a training program be built for the industry, on industry's specifications. They believe too, that the entire field of aeronautics:—engineering, mechanics and piloting are all closely interwoven and that a student should train in a school that teaches all of these important divisions. Above all, they believe that aviation should be taught in an environment of aviation activity, taught where the greatest aviation developments originate, taught where there is the greatest number of men actively engaged in aviation. This is why California Flyers is located in the heart of the world's aviation capital on the world's busiest testing field.

If this is the kind of school that you would like . . . friendly, efficient, modern and thorough; an aeronautical school operated by practical aviation men, you will be most interested in reading the *complete* story of California Flyers in the new 64 page catalog which tells today's story of aviation at work, complete details of the training courses and just what it takes to be a *California Flyers man.*

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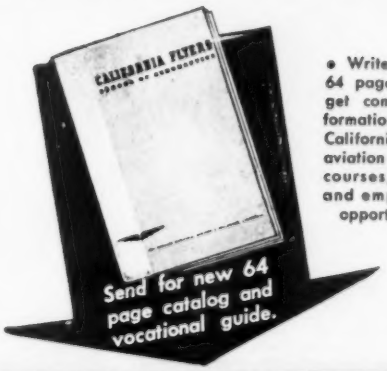

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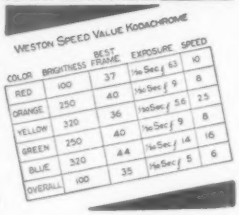
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BLUE 320 44 1/50 Sec. f 4 16
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HERE'S A PARTIAL LIST OF CONTENTS:

Camera Settings Simplified
Consider the Film's Problem
What Is Incorrect Exposure?
Substitute Measurements for Judgment
What Is an Electric Eye?
Measuring Illumination and Brightness
How to Hold an Exposure Meter
Making Uniform Negatives With a Movie Camera
The Science of Exposure
Make Your Meter Direct Reading
Improving Negative Sharpness
Measuring Film Densities
Negative Range Measurement
Reading the Negative
Lighting for Color Filters
Scene Brightness Range Exposure
Texture Scenes
Portraits
Night Photography in Color
Projection Data
Emulsion Speed Values for Various Colors
The Art of Exposure
Photographic Quality
Controlling Scene Lighting
Fitting the Scene to the Paper
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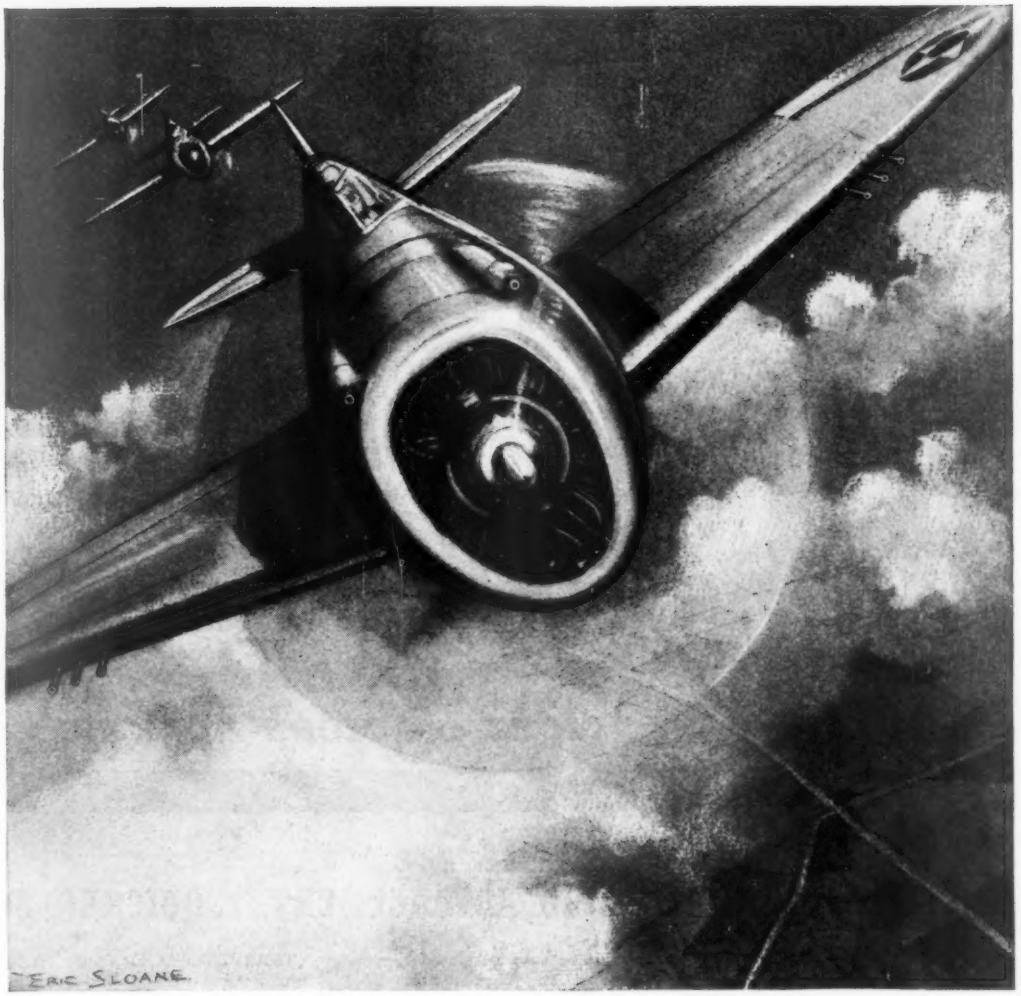

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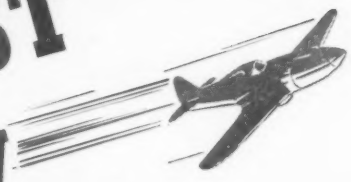

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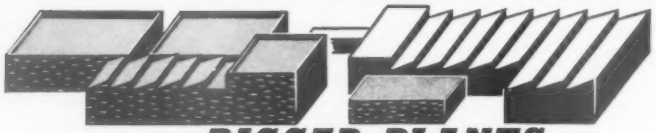

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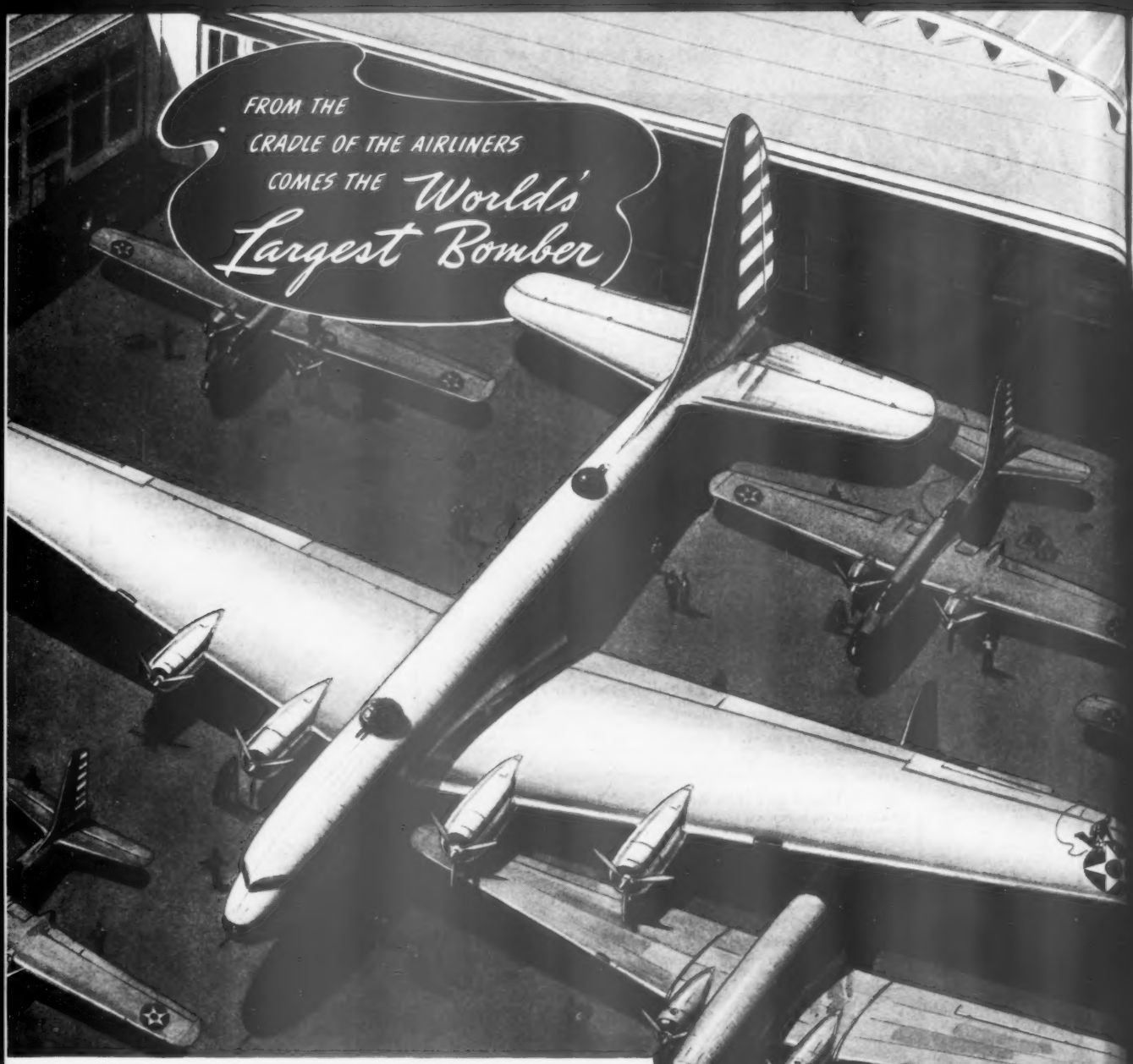

With a wing span greater than the height of a 17-story building the new Douglas B-19 carries a bomb load of 18 tons and can fly non-stop one third the way around the world. By serving the needs of both the Government and Civil Aviation, Douglas acquired the experience and vast facilities to make so great an airplane possible. Thus from the cradle of the airliners comes the world's largest bomber to help make America supreme in the air.

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Newest dive bomber-fighter for the Navy is this Vought-Sikorsky F4U-1.

Vought SB2U's (above) and Grumman F3F's (left) are Navy dive bombers.

DIVE BOMBER

by ENSIGN SEYMOUR KAIL and HAROLD KEEN

Though Germany made the dive bomber a household topic, the U. S. Navy actually devised and perfected this aerial arm.

OF all Hitler's imported instruments of warfare that American-developed weapon, the dive bomber, probably inspires the grossest misconceptions. These can be laid to the devastating force with which the Nazi *Luftwaffe's Stukas* have struck. Stories of the terror spread by this weapon—about which the public knew little—has inspired the impression that supermen must pilot these terrible meteors of death as they plunge earthward at speeds of hundreds of miles an hour—that no craft in the world can match the "new" scourge of the skies.

The strategy of terror is part of the kind of war waged by the totalitarians and the dictators have not been unhappy because the world has gained the impression it has of their dive bomber. But in this country, these false notions—which are designed to inspire fear—may well be cast out of the public mind.

For dive bombing is not a dictator's invention—our Navy began it 16 years ago. There are many types of planes which can execute the attack—even to some types of observation ships. It is not done by super-pilots; any graduate of our Navy's flying school at Pensacola can dive bomb.

The planes which are intended primarily for dive bombing are based on the Navy's six aircraft carriers. There are several squadrons of these diving planes on each carrier and each plane can carry at least one 1,000 pound bomb. Many types of planes can be used for dive bombing. Among the planes best suited for the kind of diving required—some of which types are being tested in the European war—are the Vought SB2U's, Curtiss SBC-4's, Grumman F3F and F4F fighters and Douglas SBD-1's.

There are, then, several hundred first-line planes ready for sea duty which are intended primarily for dive bombing. In addition, there are planes in Naval Reserve squadrons and numerous other planes which could be quickly adapted for dive bombing. In proportion to the size of our Naval air force, we are fairly well prepared with planes capable of performing the *Stuka's* mission.

The training of a Navy flyer in this

Maj. Al Williams, demonstrating dive bombardment, pulls his Grumman fighter out of its dive as the bomb hits the target.

A sturdy Navy type used for dive bombardment in the Curtiss SBC-4. The streamlined "bomb" on the lowest ship's fuselage is a gas tank.

type of attack begins when he is a student. Regardless of what type of plane he is to fly when he earns his commission, the student is given several hours' instruction in dive bombing before he leaves the school at Pensacola. It is a small part of the 300 flying hours he gets, but it is enough to give him the rudiments.

The student uses as a target small buoy-marked circles in the bay adjoining the station. He will drop at least 25 missiles and most of his dives will be rather shallow, enabling him to make several practice shots during a single flight without suffering from the effects which steeper dives might produce. The water targets are marked in concentric circles of 100, 50 and 25 feet and many student pilots are able to drop all their bombs within the 100-foot circle, with a good proportion in the 25 foot area.

The Navy long ago learned that the only way to make a crack dive bomber is to give him plenty of practice. So those officers who make this their specialty are kept at it. Their first dives are done with baby bombs, loaded only with a "signal" which releases smoke on contact with the surface and shows where the bomb hit. Later, they use 100-pound dummy bombs filled with water, then are allowed to load with 500 and 1,000-pounders.

The usual target for experienced pilots is a slick patch on the water, created by dropping a sack filled with aluminum powder. The more expert bombers try their aim on moving targets, towed by armored motor boats. Sometimes the dive bombers hold drills during which they attack a real battleship—the *U.S.S. Utah*—with water bombs. This armored ship is radio-controlled, without human crew and dodges about in the unpredictable way of an enemy vessel under attack.

The physical effects of the dive have been exaggerated somewhat. It has been said that continual practice will cause impairment of hearing, but the experience of the Navy medical bureau in no way bears this out. To some extent, the effect of diving depends upon an individual's physical condition, upon the kind and number of the dives. Neither an extraordinarily powerful stature nor superhuman stamina is required—and the average, healthy young pilots who dive bomb for the Navy would be the first to scoff at such an idea.

Some flyers will experience upset stomachs and other ailments as they rush earthward or go into the "blackout" which sometimes comes with straightening out. Others will feel little discomfort, beyond a slight crackling in their ears or spots before their eyes as the blood rushes from their head. Those whose stomachs do flip-flops on elevators can get an idea—if they multiply that sensation by a thousand—what the aviator feels like when he drops 15,000 feet at a speed of 350 mph. Two or three dives will leave some pilots weak and some will be forced to pull out of a dive because of the pain. But most report no particular effects, provided they are in good physical condition. The slightest trace of such an ill as a cold is enough to excuse a diver from duty.

Tales of Germans swooping down at speeds of 500 to 600 mph. are pure fantasy. To unseasoned ground troops or householders, the thunderous plunge of the men from the sky may seem to be at this great velocity. Actually, most dive bombing is done at speeds a little more or a little less than 350 mph. At greater speeds the plane is too difficult to control. The slightest movement of the stick would throw the plane off course. Too much speed is not efficient in this kind of flying.

This will come as a revelation to many who believe that the plane, as soon as it is pointed toward the target, is allowed to fall freely—or, better still, is urged on by a throbbing, high-powered motor. In reality, the moment the plane "peels off" into the dive the engine is throttled down somewhat and the "brakes" are applied by opening out the flaps on the wings. The landing gear—pontoons or wheels—on some of our dive bombers acts as a further drag force, like the fixed, non-retractable wheels on the Junkers Ju-87 *Stukas*.

Our Navy's dive bombing is done from maximum altitudes of about 20,000 feet.

(*Continued on page* 82)

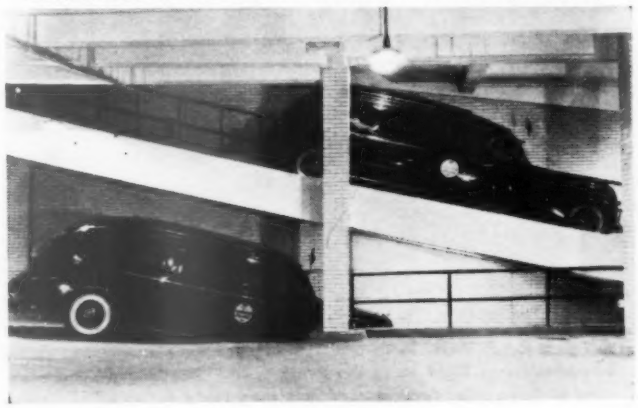
Outgoing passengers get to ticket counters from street level by escalator. Incoming passengers go through another part of the building, avoiding congestion.

AIR DEPOT

THE building on the corner of 42nd Street and Park Avenue, New York City, opened January 25 and already is in need of expansion. It is six stories high, cost all the airlines using it a total of $5,000,000, yet expansion plans are being considered almost before the concrete has set.

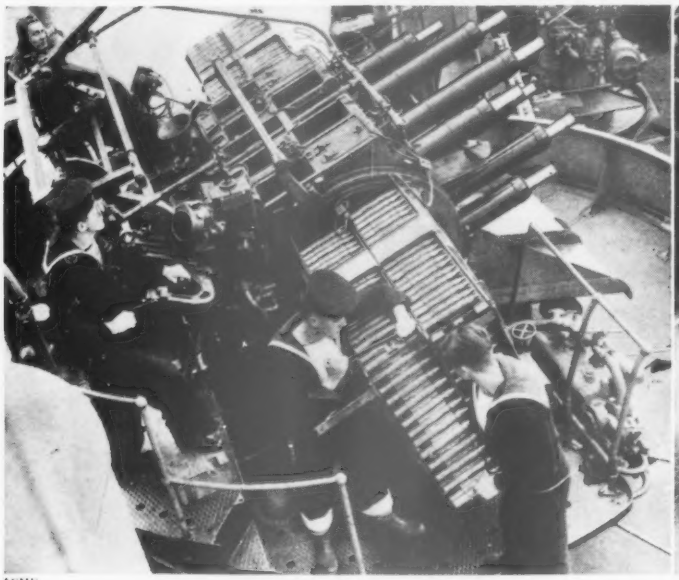
These are the unusual facts on New York's Airlines Terminal, the building established by the airlines to handle incoming and outgoing passengers between LaGuardia Field and the city proper. The building has four basements, a penthouse, 60 offices, a 22-microphone public address system, "levelators" for six motor coaches, a restaurant, cocktail lounge, restaurant and movie theater. Its airlines are United, American, TWA, Eastern, Pan American and Canadian Colonial.

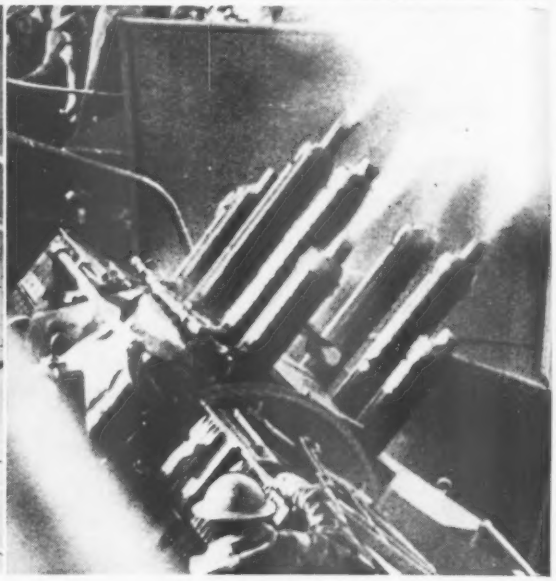
Top coach goes to first basement to unload incoming passengers. Empty coach drives to second basement. Levelator takes it to outgoing group.



Passengers leave rotunda for coach on levelator. Baggage (inset) goes to cars on conveyor belt.

THE WAR

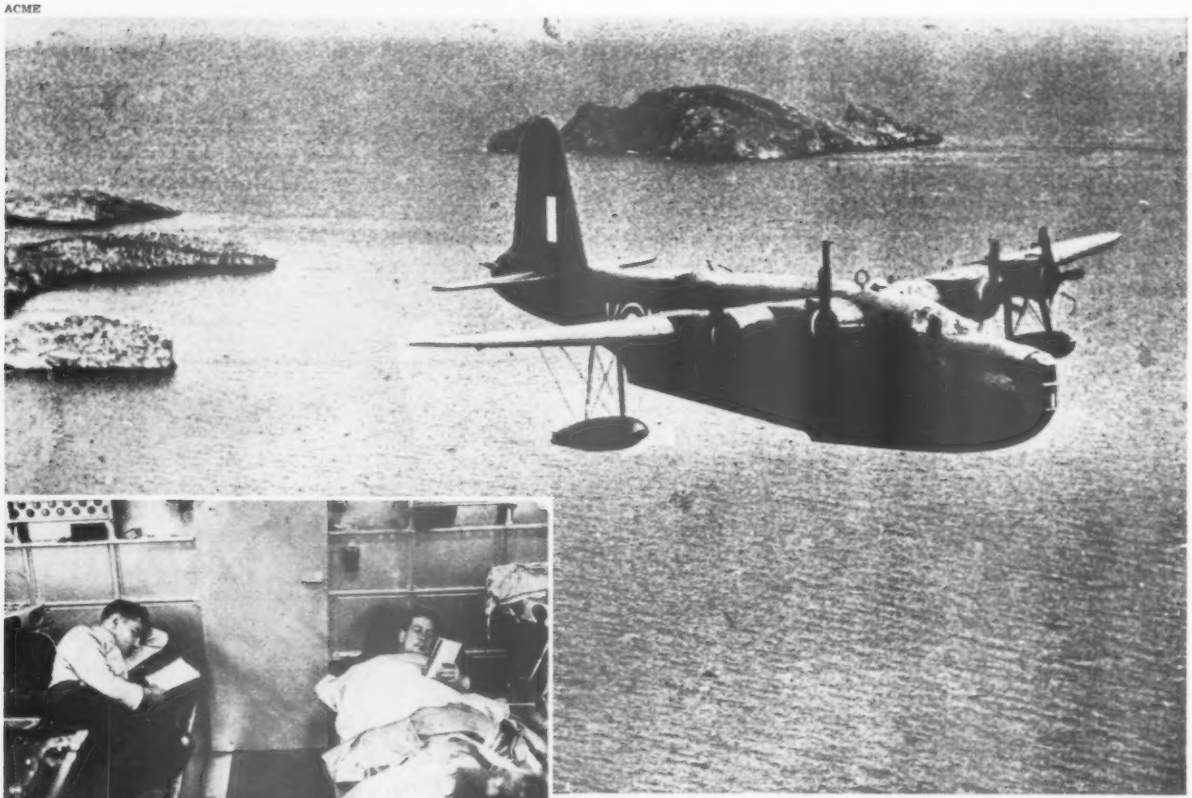




ACME

This deadly eight-gun battery of rapid fire cannon is standard equipment aboard large British naval vessels. Picture at right shows battery firing at attacking German warplanes. Note size of shells.

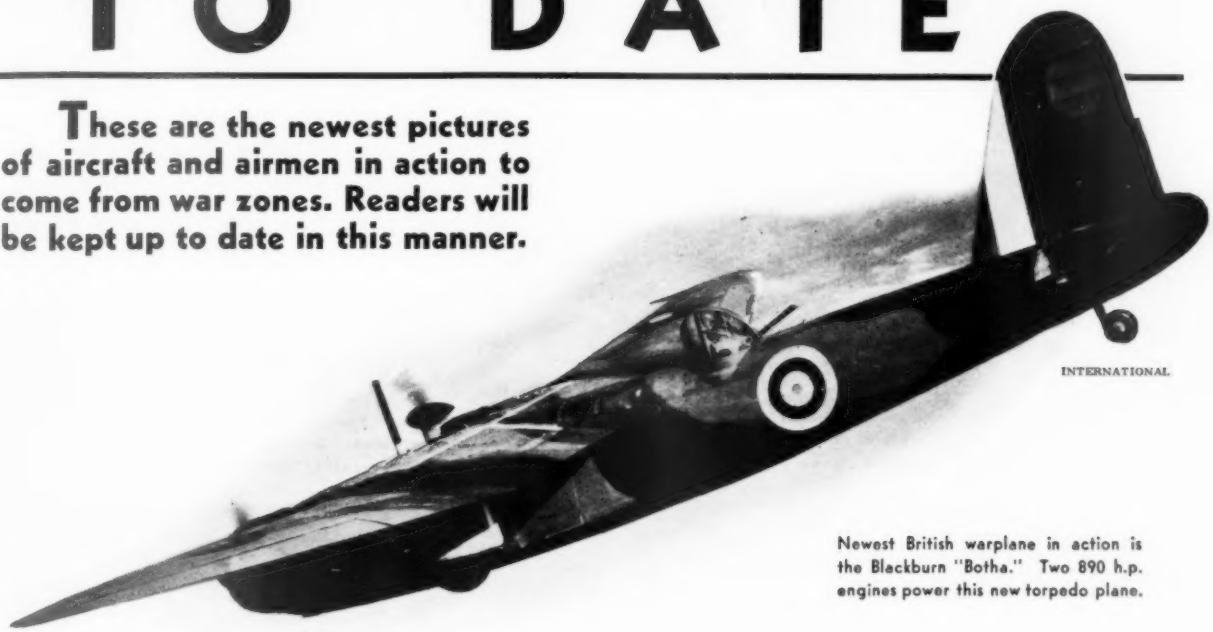
ACME



This giant R.A.F. Short "Sunderland" patrol plane was photographed during a reconnaissance flight along the Greek coast. "Sunderland" crews take turns at flying ship, sleep or read in plane's bunks during relief (inset).

TO DATE

These are the newest pictures of aircraft and airmen in action to come from war zones. Readers will be kept up to date in this manner.



INTERNATIONAL

Newest British warplane in action is the Blackburn "Botha." Two 890 h.p. engines power this new torpedo plane.

ACME

The gunner in the Italian bomber above photographed bombing of Albanian town.

"Stick" of British bombs (below) ends up squarely on docks at Valona, Albania.

ACME

ACME

About to leave on a night raid over Italian objectives in Albania, this R.A.F. bomber crew boards its Vickers "Wellington" based "somewhere in Greece."

BRITISH COMBINE

R.A.F. bomber flyers practice use of rubber boat, in case of forced landing in ocean.

ACME

British soldier demonstrates rubber boat taken from captured German Dornier Do-17 bomber. Hand pump on soldier's chest is to keep boat inflated over long periods.

INTERNATIONAL

Blurred because of great enlargement from original 16 mm. movie film, above picture was taken automatically when "Spitfire" fired at German Heinkel. Note tracer streaks.

ACME

Captured German pilot, arriving at Canadian prison camp, is searched by guard.

Frequently "sunk" by Germans, British carrier "Ark Royal" is in Mediterranean. Plane is Fairey "Swordfish."

ACME

ACME

To overcome mud, soft earth and bomb craters, Germans use metal blanket for airport runways. Similar materials also are in use by Royal Air Force.

ACME

A large aerial bomb to be dropped over England is about to be loaded aboard a Heinkel bomber. Note plane (left).

INTERNATIONAL

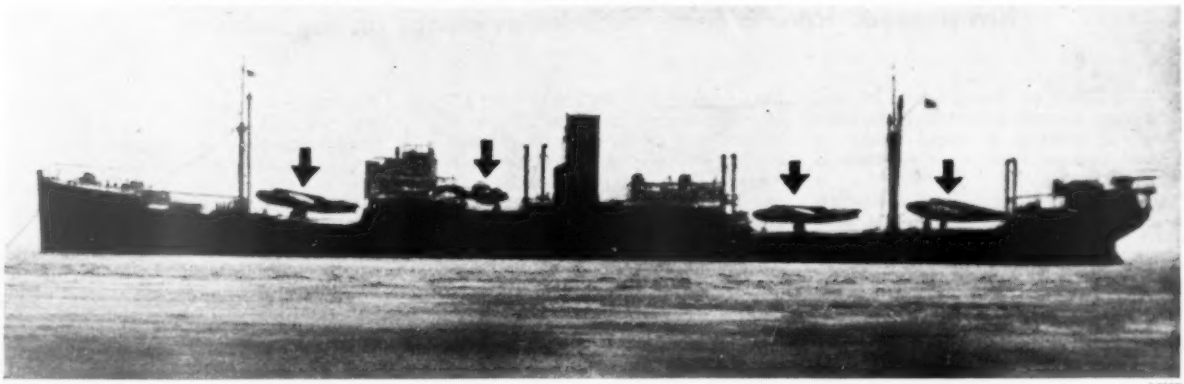
Now in training at Toronto, Canada, is Royal Norwegian Air Force. Some Norwegian flyers already are fighting with the R.A.F. Plane in background above is American-built Fairchild M-62 trainer (175 h.p. Ranger engine).

Now being delivered to Royal Canadian Air Force are Cessna T-50 twin-engined trainers. First delivery is above.

Hawker "Hurricanes" below are part of Burma Squadron, first R.A.F. fighters to go into action against Italy.

ACME

British freighter leaving New York carries Douglas "Bostons" (first, third arrows) and Lockheed "Hudsons."



ACME

GROUND SCHOOL - Minus Books

JAM HANDY

The most intricate mechanisms are made clear by projection method.

by JOHN R. HOYT

Perhaps the day of the lecturer and textbook in aviation has passed. Here is some definite evidence on the subject.

ACCORDING to the prophets of old, a good picture is worth a thousand words; most of us would rather see a good picture than wade through a thousand words.

That theory is used in the modern method of teaching ground school subjects. In a semi-darkened room in a well-known airport administration building, a control group of students have just finished a course in Civil Air Regulations. There have been no texts, no hard reading. As you know—if you've ever read them—the regulations must have been written by a man with a Rube Goldberg mind; the more an idea could be confused or the more devious way it could be presented, the more legal and efficient the regulations seemed. But to most of us they seemed tough. The average person took many hours of hard work to read, understand and pass the examination on the regulations—and then, as likely as not, pass by the "skin of his teeth."

But today a dark room is used for lectures! The students sit and watch pictures and absorb the subject visually. According to experts, we learn by seeing —87 per cent of everything we know has been learned by the visual process. If it is natural and easy to learn that way, why not concentrate on such a method? Why not use it and thus streamline our teaching?

In the semi-darkness, an airplane is shown on the screen. To the right is a cloud, with the figures "1,000 feet" written from the wing to the cloud. To the left is another cloud, 1,000 feet away. You've guessed it; to go above the overcast you must have a hole 2,000 feet

across. Easy? Yes—and clear. More than that, it takes about one-fifth the time to grasp the idea than by the word method. And, after grasping the thought, it stays put.

The method is so good that it now is being used by the Army to teach aviation subjects to new recruits. Obviously, we must have a million mechanics if we are to have a huge air force. But we cannot have that many mechanics if we teach them laboriously and ineffciently by the old method of dry, dull texts. We must teach them quickly and thoroughly —and teach them in the same, standardized way. To teach them that way means standardization of instructors. That is a harder job than teaching the mechanics. So this modern method goes so far as to make it impossible for an instructor to forget an important point, to warp it, or to present it inaccurately.

Let's take the example of "right of way" to illustrate how confusing the old method can be. Some instructor will say: "The plane on the right has the right of way." Another will state it more accurately: "The plane that has the other on its left has the right of way." Clear, isn't it? Perhaps it is, but not until you've thought it over carefully. As a matter of fact, it is so confusing to many students that they never do understand when they have or do not have the right of way.

Now take a picture of this rule and flash it on a screen. Imagine yourself sitting in the dark room, looking at a picture which makes you the pilot of a plane. (The camera was placed in the pilot's seat and a picture taken looking through the windshield.) Looking through the windshield you can see a plane crossing your path and he is crossing from left to right. Underneath is a printed caption which says: "YOU have the right of way!"

The visual method of ground school training has proved highly successful with "test" classes. The Jam Handy company already is shipping orders on the tests' strength.

Clear this time—and, what is more, you'll remember that picture because it has been put across vividly by means of the eye. According to the instructor of the first group of students learning by the picture method, the average grade was 88 per cent without a single textbook having been used!

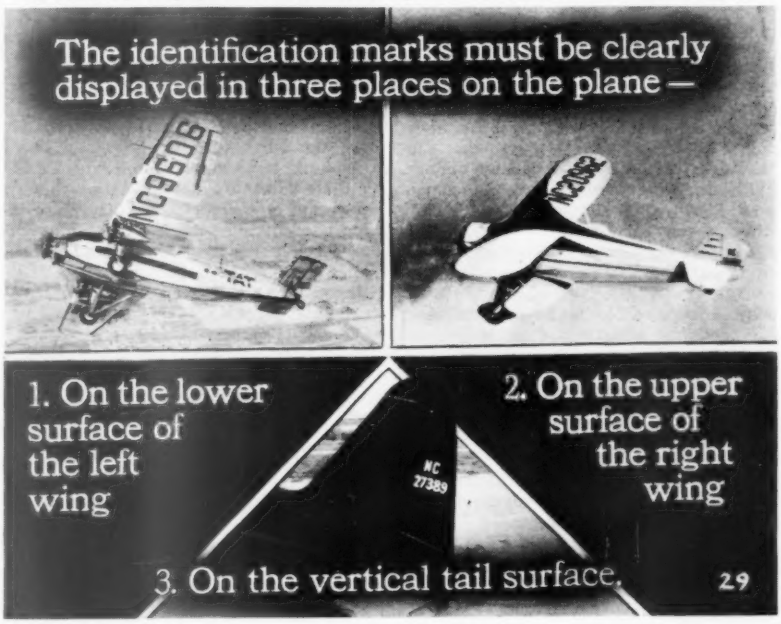
The first use of this idea was not as recent as one might believe. It was used to train automobile salesmen over 24 years ago by its inventor, Jamison Handy. What he attempted to do was to draw an idea clearly and logically. This idea was photographed on a square or "frame" of motion picture film. The next idea occupied the succeeding square, so that instead of obtaining a moving picture he got a "still" picture or a series of slides.

Thus, the equipment is simple. That is the main reason for using a slide device instead of a motion picture. A movie would cost more to produce, be more difficult to show and be very expensive to replace. As every one knows, both the regulations and the theories are constantly being revised and when this is done a film becomes obsolete; a slide film can be easily and cheaply replaced.

Let us examine the method used by the Army in training mechanics. Now that the Army is being mechanized, hundreds of thousands of mechanics will be needed. By having a single method of instruction, each mechanic can be sent to a school that is the same in California as it is in Texas. In the lecture room will be an instructor and as many men as he can talk to at one time, usually a convenient number of 50. Suppose he is going to teach them engines—the same as a pilot would study—and the combustion gasoline engine in particular. First, a roll of film would be inserted in the slide machine, a roll containing about 100 pictures concerning a single phase of the subject: say, the carburetor. With a twist of his finger and the snap of a switch, a simple venturi and a discharge nozzle are shown on the screen. The captions already are printed beneath the picture; no chance for the instructor to make a mistake. Every man gets the same, accurate impression.

From there to fuels, feed systems, ignition, lubrication and the four-stroke cycle, until nearly 800 pictures are shown. The entire phase takes several days because psychologists know that the brain can absorb only a given amount at a single sitting. At the end of the course, an examination reveals that al-

A typical frame from a ground school film is that below which makes its point clear with actual photographs. Number in lower right-hand corner identifies frame sequence.


The identification marks must be clearly displayed in three places on the plane —
1. On the lower surface of the left wing
2. On the upper surface of the right wing
3. On the vertical tail surface.
29

40°
Now the airplane loses its tendency to nose down. It may go into a stall for which the designer did not provide control at low speed.
50

In the film dealing with aerodynamics, this frame helps illustrate placement of weights throughout an airplane. Result is that an otherwise difficult subject is clarified.

most all the men understand the subject and have learned it with half the effort and one-fifth the time.

Of course, learning any subject is hard. One cannot learn painlessly. But the slides do reduce the torment of dull lectures, poor instructors and dry texts. The entire course that the Army gives is called a "blitzkit" and consists of 35 slide films, divided into five parts of about 600 pictures each. They concern the gasoline engine, transmission of power (clutches, gears, cogs), mobility factors (wheels, brakes, bearings), electrical systems and trouble shooting.

Naturally, a mechanic must have practical training and experience too—just as a pilot must actually fly. But the point is that the ground school is covered much more rapidly by visual education than by oral instruction. If we are going to have a million mechanic-sergeants, we must get them in and out of the ground school as rapidly as possible.

That idea was emphasized when the President called for 50,000 pilots. In order to streamline the ground school training of the pilots, a slide film was taken to Washington for a short trial. After a small group of students viewed the films, they took the CAA tests and came through with passing grades. Not brilliant grades—but after all, they did not study; they merely viewed the pictures!

One reason the students grasped a question was illustrated by the class in meteorology. The entire subject was covered in eight rolls of film, running between 75 and 100 pictures in each roll; in one roll was cloud formations. We have all studied cloud formations without ever having been able to call a single one by name when we got outdoors. But this time, instead of a textbook, the students actually saw the clouds on the screen with the markings, altitudes and conditions clearly described. As each picture was shown, the instructor pointed out the salient features as printed on the film, thus directing each student's mind. Not only that, but when a point was obscure, the film was backed up and a brief review made to clinch the point. The attention of the group was continually brought to a focus by the lecturer as he guided their minds. His own mind was guided by the captions which left no chance for omission or mistake. The presentation is so thoroughly streamlined that when the students go outside they know their clouds remarkably well.

In teaching any subject it is found that the presentation is obviously in the same logical order. But, one might ask, what would you do if a brand-new instrument were invented? The answer to that would not be so simple if a moving picture film were used, because that would involve a more expensive change. With the slide methods, such a change would be quite simple, as would any other revisement.

In teaching instruments, instructors find that the words "pitot-static tube" mean very little. Nor is it quite clear why an airspeed indicator reads a lesser airspeed at 10,000 feet than it does at 1,000 feet. But draw him a picture of it—put it on the screen—and presto! it becomes quite clear. It is also clear to a young pilot why he should never allow a pitot tube to become bent or filled with dirt and water.

After the experimental group in Washington passed their tests with excellent results, the CAA approved the use of the films in the Civilian Pilot Training Service. A complete set was then given to some CPTS instructors at a well-known airport and a control group of 50 non-college men and women chosen to take the course. In order to make it worth their while to pay close attention, 10 of them were to be selected on the competitive basis for flight training under the CPT program.

There were no texts used. The course consisted of three parts, similar to the CAA test: regulations, theory of flight and meteorology. The first part was composed of six films, the second of 10 films and the third of 8. The method of presentation followed the custom of presenting a single roll to the class when it assembled Tuesday nights. As they sat in the darkened room the instructor turned the slide and read each caption slowly, in order that each student would be guided to each point of interest in the picture. Then, before anyone had a chance to become tired, the instructor would turn to the next picture. Of course there were points that were not clear. But whenever a student felt doubtful of a point, he would make a note of his question rather than interrupt. This permitted a constant change of picture and a steady flow of thought.

After the film had been run through, it was again presented to the class, but this time each point was discussed until everyone understood it clearly. The entire showing and discussion period lasted practically two hours and, at the end of that time, every student had learned something about aviation.

By convening twice a week they were able to conclude the course in from 10 to 12 weeks, having studied 48 hours and absorbed every single point in the "lectures." Thus, the control group really learned their ground school subjects without the aid of a single textbook and without an instructor. The instructor merely guided them through the slide film as he turned the film through the projector.

The results proved the case. In 24 lessons of two hours each, the group of 50 non-college men and women were able to take and pass the examination, making the astounding average of 88 per cent! The students themselves admitted that it was hard to sit down and dig the material out of a text and that it took a long time. But to sit down and *see* the subject matter—well, seeing is believing, and much simpler besides.

Slide films are not new, but this application of them is new. They are being used because there is a terrible need for speed, action and a streamlining of pilot production. If we are to have thousands of competent pilots we cannot produce them by an obsolete method. We must have standardized production, led by instructors who know how to teach and are guided in their teaching. With a slide film we can at least get rid of any ground school bottleneck, be it in pilots or mechanics or meteorologist. More than that, we can improve the standard of production even as we increase the rate of production.

Now all that remains is for some genius to achieve the same with flight training—solo to combat in 24 easy lessons!

END

These rookie paratroops are going up for their first 'chute jump.

PARATROOPS

PHOTOGRAPHS FROM ACME

Landing without injury is practiced by paratroops by jumping off high platforms.

UNCLE SAM isn't too slow in catching onto such things as parachute troops. Hitler had no more than conquered his first outpost with these streamlined soldiers than the U.S. Army went to work on its paratroops, among them the 501st Parachute Battalion, Fort Benning, Ga. The men shown rehearsing their deadly work on this page are the Yankee pioneers in this sort of warfare. So far, there are few paratroops in the Army. But many of the men shown in training here will go out into the rest of the Army as instructors as new paratroop units are established. Their main task is to cut communications and cripple transportation systems as much as possible.

These paratroops are wearing plastic helmets, newly developed for parachute work.

Landed paratroops quickly go into action against enemy, setting up protecting guns while comrades attack objectives.

Students below are practicing getting out of 'chute harness while suspended in it. This is preparation for water landings.

GROENHOFF

At least one man knew that stalls and spins are dangerous and unnecessary. So Fred Weick designed this. . .

Tricycle landing gear and coupled controls make the Ercoupe simple to land.

PHENOMENAL FLIVVER

by JOHN C. A. WATKINS

Fred Weick

AFTER the din has died and kids once more can look up into the buzzing sky with interest instead of fear in their eyes, someone may give Fred Weick a medal. Maybe they'll even hold a testimonial banquet and present him with one of those shiny winged maidens poised on a globe—the sort of thing usually reserved for the hero who has turned out the year's most promising bomber.

That won't be soon, in all likelihood. People set on improving the morals and manners of their neighbors by blowing the hell out of them aren't interested in men who have devoted a good portion of their careers to saving lives. So, for a while, it's pretty certain that the only monument Fred Weick will have will be the lives of hundreds of amateur pilots for whom he has created the second airplane the United States Government ever has officially certificated as spin proof. Weick and Henry Berliner and their Engineering & Research Corporation, which has its factory within gliding distance of historic old College Park (Md.) airport, in the remote suburbs of Washington, are the manufacturers of the Ercoupe monoplane.

The Ercoupe is an airplane which most pilots who have flown it, including this writer, think is the finest and most significant ship in the history of private flying. It positively will not spin or whip-stall. When Government experts had completed the usual approved type certificate tests, they actually were so dumbfounded at the unconventional characteristics of the little ship that formal approval was withheld, although it had passed every test in the book and a few, it was rumored in Washington, that they thought up on the spur of the moment.

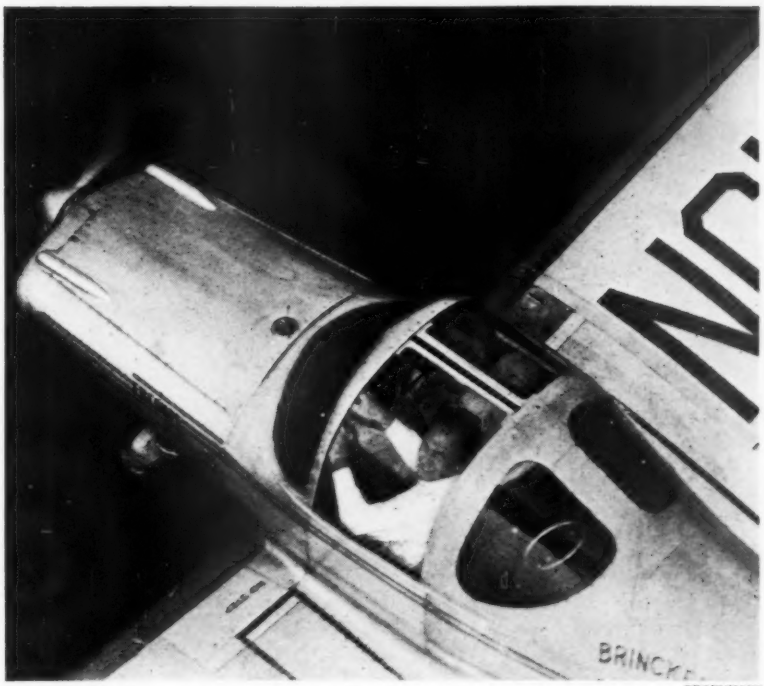
Finally, in what you might call desperation—if you ever saw a test pilot frustrated in his attempts to tear an airplane apart—they tried again. They changed the center of gravity, but she wouldn't spin. They increased the aileron travel. They did everything short of hanging sinkers from the leading edge of the wing. She wouldn't spin.

Every pilot knows that the stall, an involuntary maneuver characteristic of every conventional airplane, year in and year out accounts for more than 60 per cent of all fatal accidents in private flying. It won't in the Ercoupe, which is "stall-safe" and officially certificated now as "characteristically incapable of spinning."

Apart from a special wing design, it has two controls functioning through a wheel. There is no rudder bar. The twin rudders and ailerons are coupled together and operated through the wheel, being so linked that they are always properly coordinated. There is no need for that precise coordination of control stick and rudder which beginners usually have so much difficulty picking up and without which flying in conventional airplanes can be both sloppy and dangerous.

The tricycle landing gear is so built that it is virtually impossible to "porpoise" the ship in landings. It can be

The Ercoupe cabin resembles an auto with much visibility. Note dual wheel controls.



GROENHOFF

landed easily in cross-winds and gusts which would be dangerous to a novice, difficult to an experienced pilot in a conventional lightplane. It can be flown into the ground at great speed because shock absorbers with a full foot of travel have been built to withstand unusually great impacts.

When we were invited to fly the first production model Robert Sanders, company sales executive and pilot, went along to show us the unusual points.

"I'll show you how well it handles on the ground," he said, as we taxied along a single runway, buffeted by 20- to 30-mile gusts. He gave her the gun until we were hitting 45 or 50. Suddenly he reached over and pulled the hand-brake full on. The ship spun around and around on the snow-covered runway like an automobile on an icy street. It showed not the slightest tendency to ground loop. The tricycle landing gear is so wide and the center of gravity so low that there seems to be less tendency for the ship to tip over than there would be in an automobile.

After taking off, Sanders turned the airplane over to us. First we pulled the wheel full back. The nose climbed and the needle on the airspeed indicator dropped down and down until it hit the peg at 35. The airplane mushed along. We swung the wheel to the right and then to the left. The controls responded immediately. All the time the nose was dropping slowly and, as it dropped, we regained speed. By the time it was down slightly below the horizon (normal attitude) we were up to cruising. We had lost altitude, but here was no tendency to whip-stall.

There was the same strong, gusty cross-wind blowing when we came in to land on the main runway at College Park, but we could detect no appreciable effect on the behavior of the ship. Once we were down, it sat firm as a rock. However, we did come in much too fast the first time although, during the tests, it was landed at many miles an hour above normal without any harm.

"Let me have it a minute," suggested Sanders, when we were about a hundred feet off the runway, our air speed at 80 miles an hour. He pulled the wheel back, the nose went up and our speed dropped as if we had hit a stone wall. Our stomach did a few slow rolls: in a conventional airplane we'd have stalled and crashed before we knew what had happened. But Sanders then merely pushed the wheel back to normal and we settled onto the runway in what would have been a rough landing if it hadn't been for the wide landing gear and those huge, all-forgiving shock absorbers.

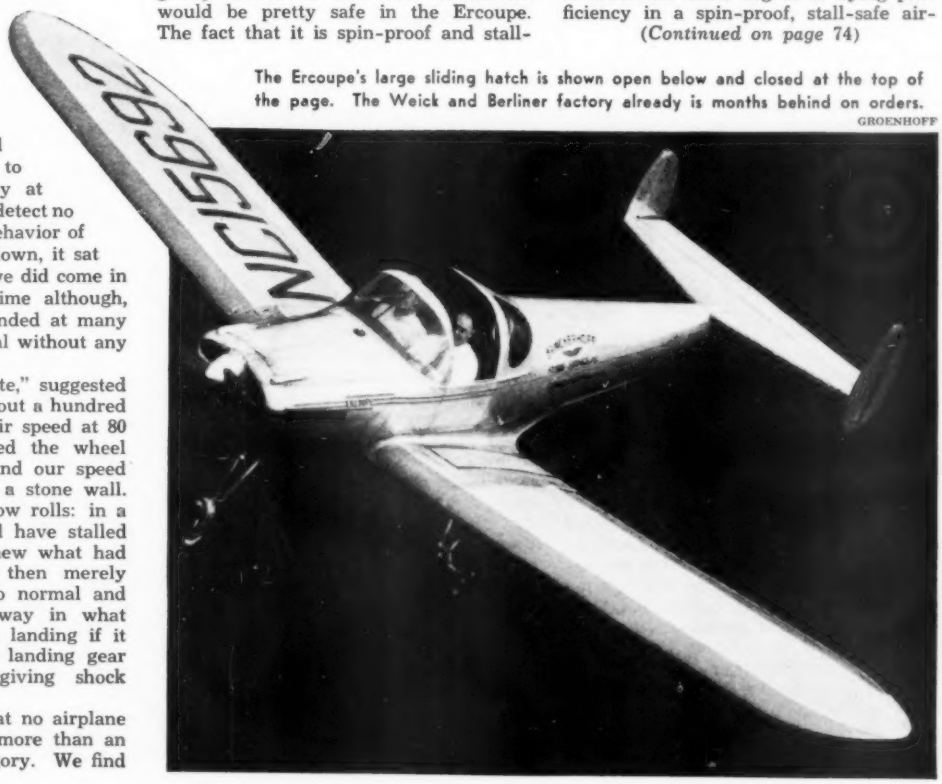
Fred Weick contends that no airplane is really "foolproof," any more than an automobile is in that category. We find it difficult to believe, after flying the ship, however, that any normal, careful person could hurt himself in the Ercoupe under ordinary conditions. The "deadly show-off" could make a corpse of himself in a kiddy-car. But with reasonable care, it seems to us that a person in normal physical condition and intelligently aware of his own limitations would be pretty safe in the Ercoupe. The fact that it is spin-proof and stall-proof eliminates, by the CAA's own records, between 50 and 60 per cent of the chance of a fatal accident.

At this writing the CAA was conducting an experimental flight training program to determine how long the *average* person—not the physically superior specimen, but the ordinary guy—needs to reach the same degree of flying proficiency in a spin-proof, stall-safe air-

(*Continued on page* 74)

The Ercoupe's large sliding hatch is shown open below and closed at the top of the page. The Weick and Berliner factory already is months behind on orders.

GROENHOFF



Marshal Goering (below) gives German aces medals for their prowess in aerial combat.

ACME

PILOTS-

The name of the author signed to this article is fictitious. The writer is a former German newspaperman who fought with the German navy in the first World War. He has written more than 20 books, both fiction and non-fiction, some of which were banned when Hitler came to power. Now living in the U. S., he has a death sentence awaiting him in Germany.—Ed.

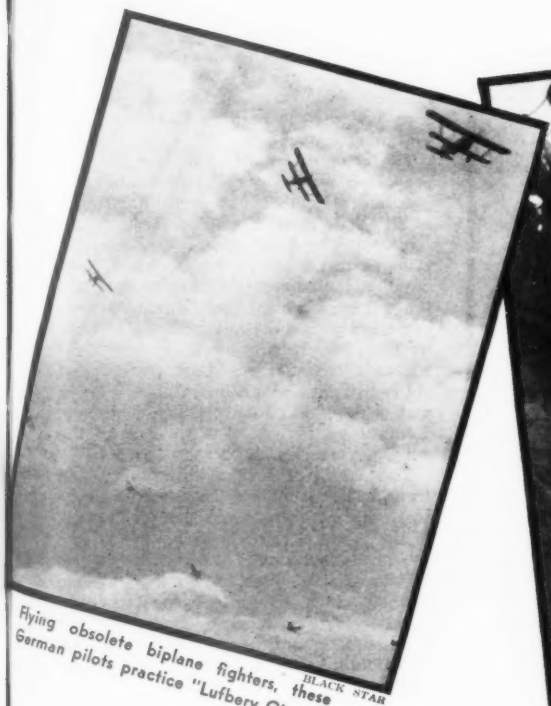
THE German air force became what it is today through the organizational genius of Hermann Goering. A great man for details, he solved organization problems down to the last detail. For example: a squadron of trainees takes off in the morning for some distant airport. Let us say the squadron takes off at Berlin and lands six hours later at Koenigsberg in East Prussia. This may be the pilots' first trip—but this is what they discover. The airport of Koenigsberg resembles to the most minute details their home port. They will find the same arrangement of buildings. They will find their living quarters in the same wing they are used to at home, their rooms will carry the same numbers and, when they arrive, they will find their pajamas laid out on the bed. Even their tooth brushes, labeled with their names, will be in the glasses on the washstands. Suppose the pilot is married. His wife will automatically get a telephone call immediately after his arrival to let her know that he is safe. In this respect Goering really acts in a very humane way.

The creation of the German air force was a break with every tradition of the Prussian army. This tradition had been a gentleman's tradition, meaning that no one was supposed to become an officer without high school education, with only the rarest of exceptions. The air force, however, had to be created out of nothing, started from scratch. Goering completely broke with the well established Prussian army traditions. A tremendous number of pilots had to be trained immediately, so the basic Prussian principle of an educational background had to be given up. Psychological experiments showed that frequently young mechanics or tailor's apprentices or even waiters showed remarkable mental and physical qualifications, in many cases superior to those of boys with high school educations. So equality was established, with the result that the social level of officers in the Nazi air force is decidedly lower than that of England's Royal Air Force or even of other branches of the German army.

To create the biggest possible reserve of pilots, Goering prepared for future generations of pilots in the public school system. German public schools teach model building from third grade on. The child is given a pleasant, seemingly harmless introduction to a future career as an army pilot. At 10, the German boy becomes a member of the Hitler Youth, whose organization parallels the army's. There is a motorized group, a cavalry group, a navy group and an air group of the Hitler Youth.

For more reasons than one, the strength of the German air force was kept secret. One of the best indications of the scale of Goering's preparations is easily seen in the highly organized air division of the Hitler Youth. This force was 120,000 strong in 1938. In that way a really huge reservoir of pilots was created. Of course, in gauging this man power reserve you must take into consideration a tremendous training death rate, due to the intense pilot training speed-up. More about this later on.

Soaring, the best possible training for pilots, is a truly German art. Invented in the United States, it was developed in Germany after World War I when the Treaty of Versailles forbade aircraft with engines. The German boy of the Air Hitler Youth, from his 14th year on, receives training in one of the soaring camps of which there are thousands. He passes the civil examinations, parallel to the training in an engine plane, in A degree, B degree and C degree. It is remarkable that the ground work of soaring is done in a very simple type of



Flying obsolete biplane fighters, these German pilots practice "Lufbery Circle." BLACK STAR

Aviation training starts among German youth at an early age. These boys are learning the fundamentals of aeronautics and soon will start their flying in gliders. INTERNATIONAL

MASS PRODUCTION

by HEINRICH HAUPT

Here is the inside story of how Hermann Goering has trained tens of thousands of German air force pilots in comparatively little time.

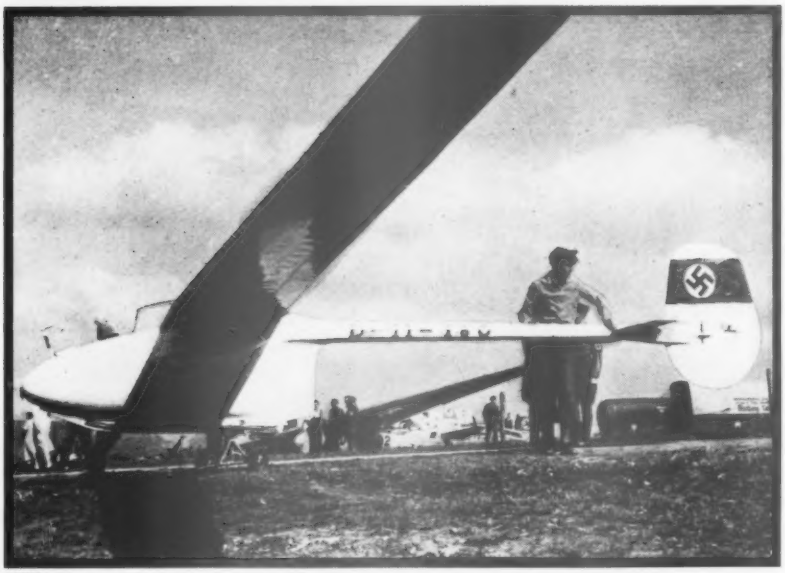
plane which costs only 300 marks, a sum hardly more than $120. With three or four years of this thorough glider training background, the boys enter the air force at 17 or 18.

Before the armament race started, commercial air transport companies required a pilot training period of years. The Luft Hansa, one of the largest of these companies, required three years' training before a pilot was allowed to take over a multi-engined passenger plane. In the rearmament hurry, however, Hermann Goering decided that six months must suffice to train a pilot for a multi-engined bomber. The result was an almost incredible strain, physically as well as on the nerves of the young men. This overwork resulted in an appalling number of accidents. It has never been known outside Germany that the average loss of men in training amounted to 200 a month in 1938. Today it is safe to say that those losses will amount to at least twice that number.

I have seen several training camps based on the Goering plan of mass pilot-production. One of my strongest impressions was the fact that in their mess rooms the pilots eat or drink practically nothing but milk. Their digestive systems have been utterly ruined through the

ACME

German youth enter the air force at 17 or 18, soon are flying first-line ships.



ACME

Much of the German air force got its original flight training in gliders and sailplanes like that above. But training casualties in power planes are extremely high.

almost superhuman requirements of the service. The training of a dive bomber, for instance, encompasses such difficult commands as: "Go up to 22,000 feet, make a power dive right down to the ground." In this, speeds of anything up to 500 m.p.h. are reached. "Level up at 200 feet above the ground, make the quickest possible landing, jump out of your machine and run for 300 yards." I have seen the trainees do that with blood streaming from their nostrils, ears and mouths because of the enormous strain on the body effected by the terrific speed and the sudden change from high altitude pressure to ground pressure. This seems astounding, but it is absolutely true.

A fast training plane nowadays acquires speeds of upwards of 300 m.p.h. If you bank steeply at such a speed, the centrifugal force developed causes the blood to rush from your head to the lower limbs. The famous "black-out second" frequently occurs when the pilot momentarily faints. To counteract this action of the blood, German fighter pilots wear rubber belts around their necks. When they bank they tighten the belt, in that way stemming the rush of blood from the brain. This sounds rather hard on the body, but has practical results in a longer, more active life for the pilot.

The pilot cannot however stop the action of centrifugal force on his stomach and intestines. The stomach liquids are actually pressed into the porous stomach wall, poisoning the bloodstream. Such tremendous physical strain upsets the normal functions of the organs and plays havoc with the digestive system. So here you have the reasons why pilots are milk addicts, it being almost the only food they can safely digest.

The technical development of modern aircraft has reached a point where the human body becomes more and more unable to handle such craft. The modern German fighting plane has a landing speed of more than 100 m.p.h. It is a rather terrifying experience for a young pilot to approach the ground at such a speed. Not only is it mentally terrifying, but it develops certain physical problems of rapid bodily adjustment that the human body has not had to face before. I have often heard young pilots say that they would just as willingly mount a roaring lion as squeeze into the cockpit of their 2,000 h.p. machines.

In many cases the nervous strain on the young men results in a peculiar cowardice. Appalling were the numbers of so-called forced landings which simply resulted from the fact that the pilot was afraid to carry on, his nervous energy being exhausted. If today British reports of German damage are so widely different from German claims, it is safe to say that this difference is the result of the young pilot's natural tendency to overstress the effect of his bombing activities in order to create a good impression on his superiors. This untruthfulness is one of the worst results of the Nazi education in blind obedience.

The German army was the first group to realize that the Nazi party education of blind obedience was the worst possible any young man could receive. The army had learned in World War I that the modern soldier does not march in columns, does not fight in regular formation, is no longer led by an officer preceding him shouting orders; but that on the contrary the modern soldier is a single fighter. Isolated in some highly mechanized weapon, he must have the moral courage and personality to carry on and fight without commands.

One of the first objectives of the psychological department of the German army was to separate the sheep from the goats. By numerous and very clever methods they tried to dig out boys from the vast Hitler Youth man-power training machine with sufficient initiative left in them, not completely crushed by the training in blind obedience. The average boy with the blind-obedience education went into the infantry forces. The more intelligent boy was methodically placed in one of the mechanized divisions or in the air force.

The utter disregard of human life necessitated by the over-hasty training of thousands of pilots is perfectly illustrated in this true anecdote. The German director of the Ford Motor Company at Cologne had a son in the air force. One day the commander of that squadron paid the old man a visit and began his conversation with this complaint: "You have no idea, Mr. X, how very unfortunate I am as a commander. Last week I lost six of my young men in training." There was a dignified pause. "Oh, by the way, I forgot to tell you that the last of the six was your son."

The frightful loss of human life in training is not always the result of overwork and nervous exhaustion on the part of the pilots. Very frequently the reason lies in the hasty aircraft construction and lack of careful checking in the airplane factory. I remember one case when in blind-flying training a huge bomber crashed after only a few minutes in the air, yielding six dead. When a check-up was made, it was found that the inclinometer had been mounted the wrong way by the mechanics, so that the plane acted contrary to all the efforts of the crew to correct its position in the air. The standard of aircraft production went down considerably by necessity. The air force had to take away a large percentage of the best mechanics in the aircraft factories—mechanics who could not possibly be replaced without years of training.

The English have always held that the German pilots are inferior. That certainly is a fact and the reason for this fact is the faulty Nazi education which destroys the personal-character qualities which make the single-handed fighter effective.

The training of a fighter pilot costs the Hitler government around 60,000 marks. This includes the wreckage and, as a training plane costs about 50,000 marks, this is a sure indication that an average of one training plane is wrecked for every pilot trained. It also shows in dollars and cents that the combination of rush-production planes and mass-production pilots is producing a definitely inferior type of pilot. This substantiates the theory that the reflex actions of German pilots aren't quite what they should be.

The Nazi fight against individualism has destroyed the subtle value of true initiative in the German pilot. The German method of life has produced more machines and more trained war pilots than would otherwise have been possible, but the personal element has been held down to such an extent that there is a tremendous decrease in war efficiency. Aircraft, either in quantity or quality, need good men to guide them—and the Nazi system tends to destroy the finest points of the personal character of its pilots to such an extent that they cannot operate at maximum efficiency.

END

HIGH BABES

by

E. JAY DOHERTY

Every U.S. airline now carries children between the ages of 2 and 12 at one-half fare. At right is a typical baby kit.

TWA PHOTOS

The best airline passenger, from all standpoints, is the youngster. Thousands of them fly every year.

THE boy who had flown from Chicago sat alone in one corner of the waiting room at La Guardia field. Harry Youmans, passenger service manager for one of the airlines, noticed him determinedly holding onto his bag and engaged him in conversation.

"Well," the eight-year-old said, "my father was going to meet me here and we were to spend the week-end together before I go on to school in Indiana. But I can't find him!"

This was nothing new to Youmans. He has made a job of taking care of bewildered airline travelers, young and old. "Tell you what I'll do," he told the youngster after hearing all the details of the story, "I'll try to locate your father and, if we don't find him, you and I will do New York."

A dozen telephone calls failed to reveal the whereabouts of the boy's father, so Youmans long-distanced his mother in Chicago, from whom he received instructions to forward the boy to school in Indianapolis. This he did only after introducing the child to some pilots and hostesses, taking him through the immense hangars at New York's airport and spending part of the afternoon at the movies.

One man had spent his entire day trying to make a half-fare passenger forget that his father was too busy to see him. The airline chalked up the expense to "passenger service," an item that occupies a conspicuous prominence on any airline's budget.

The episode of Youmans and the eight-year-old is not unusual. The airlines are making a determined effort to capture the travel business of women with children and the mainspring of this drive is the individual service they are prepared to render to make travel with babies and young boys and girls less of a task than it used to be.

The modern way of traveling is a far cry from the grin-and-bear-it times when a mother packed three bags full of babies' diapers, formulas, toys and blankets and prepared herself for an unpleasant siege that would last for from four hours to four days. A trip by air is seldom longer than an overnight stretch, even for a coast to coast trek.

For many years, mothers—yes, and fathers—have shunned the thought of taking their children in airplanes because of the uncertainty during bad weather, but mostly because of just plain fear. Until recently, a baby being carried onto a transport plane would elicit "ohs" and "ahs" from spectators, as well as headshakings that indicated disapproval of exposing children to such great dangers.

But the airlines have conducted a smart selling job and backed it up with an amazing safety record that has convinced more reluctant parents than ever before to travel with their babies.

It is only within the past three years that the half-fare has been put into effect, making children's air fares comparable with surface transportation charges. Every United States airline now carries children between the ages of 2 and 12 at one-half the one-way or round-trip ticket. This entitles your son or daughter to all the privileges of a full fare ticket. Meals are supplied free, a seat is reserved, no reduction is made in the baggage allowance for a half-fare ticket and every consideration is given to comfort and convenience.

One of the major transcontinental airlines carried 3,206 passengers between the ages of 2 and 12 during 1940. These were half-fare ticket holders; the line did not count the number of babes-in-arms carried during the year.

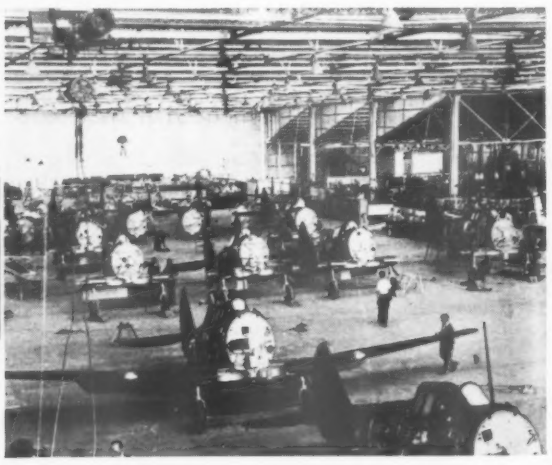
If your child is at least eight years old he can travel alone and you need have no worries about his being taken care

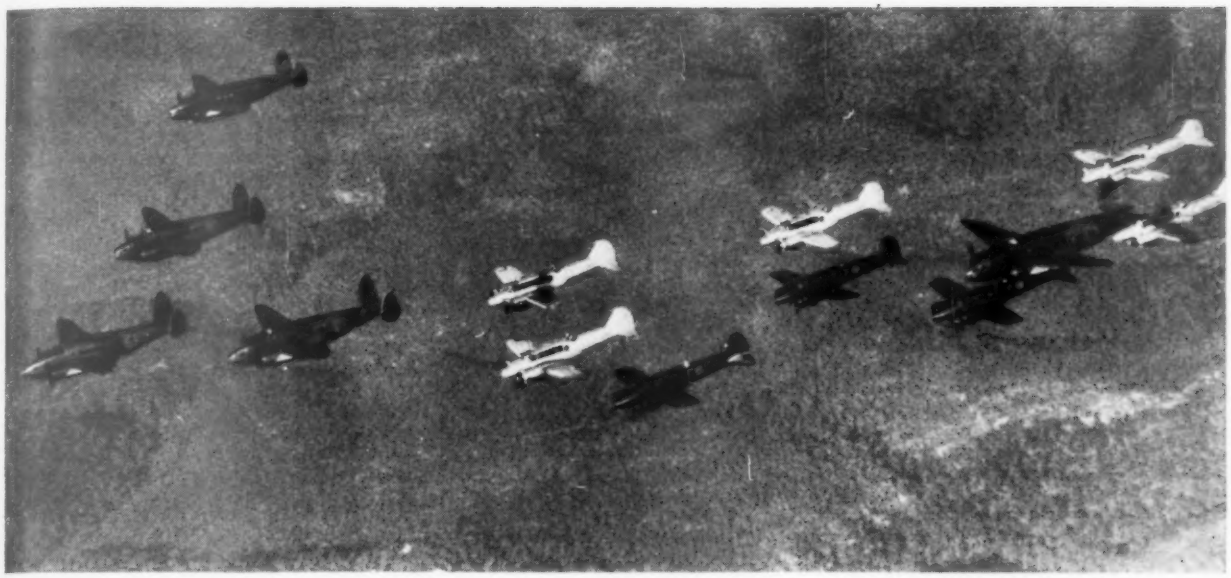
(*Continued on page* 83)

Britain's AERIAL OUTPOST

by JAMES BASSETT, Jr.

Backbone of Australia's training program is the North American "Wirraway," built under U.S. license. It is built at Commonwealth plant (below) which also builds "Wackett" primary trainers. Women workers are used extensively in aircraft manufacture (left) and are playing an important role in Australia's warplane program.





Lockheed "Hudsons" (leading formation) and Avro "Ansons" on patrol near Sydney.

Australia's tough R.A.A.F. airmen are keeping the official British eye on Far East developments. Theirs is a big scouting job.

DULL, gray, menacing, the clouds bore down over Richmond Air Base, a sprawling military field that encompasses lands over which fine Australian mutton once grazed. Sydney, with its superb harbor, lay a few miles east. North and south from Sydney stemmed the 5,000 vital coastal miles which the Anzacs must protect in order to continue living as free British.

Richmond throbbed with activity. Off the turfed runways thundered American-built Lockheed *Hudsons*. Aloft, they would attain the 240 m.p.h. cruising speed produced by their 950 h.p. engines, "souped-up" by the Australians. Their bomb racks were filled with TNT projectiles manufactured at the Commonwealth Explosives Factory at Maribyrong, Victoria; their machine guns came from Australian armories; their men, from chief pilots to rear gunners, had been trained on Australian soil.

A squadron leader, wearing shorts, poked at the handkerchief in his striped sleeve: "Demned good ship."

Murk swallowed the *Hudsons*. Six of them, roaring toward the Tasman Sea that washes the shores of Australia and New Zealand. Forever watching for the enemy that some day may strike at them. They would remain away for five or six hours. Low over the gray waters, they would patrol.

"Alert," said the squadron leader, "for hanky-panky."

That is how this writer, late last fall in the second year of the Second World War, met the Royal Australian Air Force. In a way, it was like arriving unexpectedly back home for the *Hudsons* originally had emerged from a factory in my home city of Los Angeles.

The squadron leader seemed inclined to talk: "Of course we're readying ourselves for invasion. That's always a threat. Especially if the Dutch Indies or Singapore were first attacked. Probably they'd come by air. But because of the nature of Australia, they'd bring their carriers. Maybe they'd have 400-500 planes to launch at us."

He did not have to identify "they"—who could have been none other than Japan. Then his face brightened as he cited the time-honored axiom that an attacker needs a four-fold superiority in numbers over a defender. It is to be hoped that the ruling holds true, for that is precisely the ratio today of Australia's fledgling air force to an armada capable of leaving the decks of Japan's 10 (perhaps 11 by now) carriers.

Australia stands as one of the British Empire's richest bread baskets. Its wool, wheat and mutton joins New Zealand's lamb in the desperate race to feed the beleaguered motherland. To reach England (or the Anzac troops fighting Mussolini's warriors in Africa) these products must run a gauntlet which in time might become hostile. Ship lanes to Australia are lifelines.

Her small navy of 11-odd cruisers and destroyers has been dispatched to the Mediterranean arena. Which leaves the No. 1 defensive force of this continent of 3,000,000 square miles (larger than the United States) the R.A.A.F. Actually, Australia boasts 11,130 coastal miles. But fortunately, "only" 5,000 need the daily patrolling of *Hudsons*, Avros and Bristol *Beauforts*-yet-unborn in the new factory at Sydney. These strategic miles lie between Adelaide, on the edge of the Great Australian Bight, to Port Darwin in the sweltering, dust-laden northern tropics. Elsewhere is unpopulated desert, for the continent hasn't been pioneered extensively beyond the littoral strip.

Later in this yarn we shall discuss another Empire outpost—Hong Kong—which isn't a bread basket at all. Yet, in its way, that China city means much to Britain; for it is a liability which, in an enemy's hands, might become a terrible asset.

With great vividness we recall a three-fold, simultaneous interview with the three Australian chiefs-of-staff: Sir Ragnar Colvin, Navy; Maj. Gen. John Northcott, Army; and Air Marshal Sir Charles Burnett. We sat in a small, map-laden room in Victoria Barracks, Melbourne. They talked war; the dozen correspondents, assembled like so many disciples, listened to a strange story of heroism-in-the-making. We retraced time to September, 1939.

With the motherland embroiled with Germany, Australia-New Zealand on that date began massing men (to reach a total of 250,000 soldiers for the continent with a 7,000,000 population and 100,000 for New Zealand with 1,500,000). Anzacs promptly sailed for the Middle East, virtually without convoy, since the Royal Australian Navy already had sped to Europe.

So what happened? Australian National Airways' four Douglas DC-3s and

two DC-2's lost their dural burnish for a coat of brown camouflage. Vickers guns were poked through windows and doors. Makeshift bomb racks were installed below the crafts' broad bellies until, for the first time, writers' glib predictions that "commercial transports are convertible overnight into bombardment planes" seemed to have been realized. These airliners accompanied troopships far out to sea. They were the protective convoys.

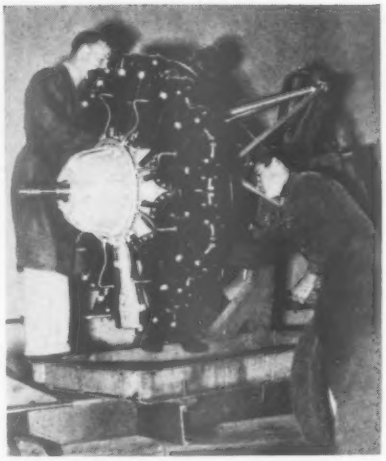
Then the hysteria passed. People knew that Germany could effect little more than sporadic Asiatic raids. They began to appreciate a grimmer fact: that all-out preparedness *must* be achieved for a greater menace—Japan.

One of the staff chiefs said: "Invasion is possible, but unlikely. Nippon's easier course would be to gobble up the Indies (if she could)." Instead of invasion, what? "Strangulation of our trade," he continued.

To defeat such a move before it gets well underway rates as Sir Charles Burnett's job. Each year, until Australia's manpower has been exhausted, he must produce 26,000 pilots, gunners and radiomen. In the none-too-distant future this saturation point will be reached, he said, for 20,000 troops at the most result from each 500,000 of bulk-population.

Last autumn Australia had about 400 effective aircraft: about 90 *Hudsons*, 250 *Wirraways* (North American combat ships built at Melbourne) and approximately 100 miscellaneous types ranging from Supermarine *Walrus* amphibians down through obsolete Fairey *Battles* to dinky *Wackett* trainers, which are Ryan-like monoplanes made by Commonwealth. Today there are more, because of the Commonwealth's burgeoning output of *Wirraways* (one-a-day in November) and its ambitious *Beaufort* long distance bomber.

This latter is interesting. Designed by the chief of the Commonwealth plant—who raised production from nothing-a-month in 1936 to present levels—this machine is a twin-engined craft capable of 350 m.p.h. In two jumps it could span Australia, the Indies and reach Singapore—in an emergency. With two 1,850 h.p. *Wasps* (also to be built Down Under), it will carry nine heavy caliber



Being built under license are American "Wasps" for North American "Wirraways."

guns, including a pair of power-turrets. By late April, *Beauforts* should start rolling from the Sydney factory.

Before Dunkirk, 10 R.A.A.F. squadrons had been dispatched to England. Now the overseas force travels posthaste to General Wavell's victorious Middle East command; and Commonwealth has home-constructed planes sufficient for a whole, new squadron every fortnight. Sir Charles frowned as he talked: "In view of our dearth of surface ships, the R.A.A.F. is pretty small. We patrol as far north as the Solomon Islands (east of New Guinea). That's covering a whale of a lot of territory (but it's the direction a southward enemy thrust would take)."

Thus the closeknit R.A.A.F. makes the most of what it possesses. Confidentially, its flyers deem the *Wirraway*—something rated as slightly above an advanced trainer in the United States—equal to the best the Japanese could send from a carrier. Modernization has given them a 500-mile range, better than 200 m.p.h. speed—on their 550 h.p. *Wasps*. But the R.A.A.F. desperately wants *Spitfires* or *Hurricanes*—or Yankee Curtisses, Bells or Vultees.

Spring and summer exercises of this "pocket air force" looked good, we were told. Men's spirits flared high. You sense this when you chat with 50-year-old volunteers who served in the last War. They have kids at home. They're quietly determined.

Across the rolling face of the continent, right to the edges of the forbidding outback country, where roam only the antelope and the Stone Age aborigine, the R.A.A.F. has its airports. Even the facilities of the commercial airways—surprisingly complete, down to a new directional beacon system—have been taken over by the government. Although official confirmation has been lacking, evidence points to a workable subrosa means of cooperation between the Dutch Indies and Australia in the event of trouble. For a quick concentration of sky-power, Australian flying fields have been splendidly located.

Sand-bagged machine gun emplacements and neat, businesslike arrays of barbed-wire greeted us at all major points such as Richmond. Here 2,000 men at a time study the mysteries of mechanics: taking one-month semi-skilled courses, or six-month ground crew training. When the war ends, these technicians will be extremely useful for the young continent.

Britain's home front battle originally diverted 150 *Hudsons* from Australia. Now, as we type these lines, word comes that almost 100 Consolidated PBY-5s will ferry south over Pan American Airways' lower Pacific run to bolster the R.A.A.F. This will be good news to Sir Charles, whose main worry has been the lack of long range patrol ships. Such machines will help protect the $500,000,000 worth of foodstuffs, about to go in transit, which England has ordered from her youngest commonwealth.

Meantime, 2,500 miles north even of steaming, humid Port Darwin, jumping-off place for the White Man's East, a non-productive area smoulders. Should the Japanese troops on the Canton frontier (20 miles away) move, the smouldering would become white hot flame. That is Hong Kong. Airplanes play a convex role at Victoria-Kowloon, the truncated double city that is Britain's last Chinese bastion.

High on a hill on Victoria Peak, we

(*Continued on page 86*)

Designed and built by Australia's Commonwealth Aircraft Corporation is the "Wackett" trainer, powered with British "Gypsy" engine. Commonwealth also makes "Wirraway" advance trainers under license.

HORNETS' NEST

Six air-minded youths made up their minds they were going to fly, and to heck with the cost. They have been at it ever since.

by
ALMA HEFLIN

Left to right: Hornet Nesters Stuart Shannonhouse, Robert Ward and Wilbur Byrd.

Thirty minutes after this picture was taken of the members cleaning the "Bronze Hornet," a pilot taxied his ship into the left wing of the Hornets' prized "Cub."

IN Mecklenburg County, Charlotte, N. C., sooner or later you will be told the story about Stuart Shannonhouse's great-great-great-great-grandfather who was a colonel and had ideas about defense.

You will be told in detail, because it is one of those yarns that take the imagination of a town, but briefly in May, 1775, Cornwallis and 600 Redcoats ran across Stuart's grandfather and 12 American soldiers on the McIntyre farm seven miles out of Charlotte. The Americans scattered and began shooting from cover. In the confusion, one of the enemy turned over some beehives and, between the bees and the sharpshooters, the 600 were routed for the time being. When Cornwallis finally captured Charlotte he said Mecklenburg County was a hornets' nest.

So it isn't surprising at a time when national defense is a subject on every tongue that you will hear about Stuart Shannonhouse and the rest of the new Hornets' Nest, if you go around the Cannon or Municipal airports. There are six of them, the youngest 16 and the oldest was an ancient of 20 when they organized. None are eligible for the CAA program, but they fly. According to Stuart, an aggressor would find that Mecklenburg County 165 years after grandfather's brush with Cornwallis still harbors a Hornets' Nest.

There are aviation clubs, junior aviators clubs, air youth organizations and the like in most of the high schools now, but with few exceptions the boys did not organize and actually finance flying lessons. That is one of the ways the Hornets' Nest of Central High School in Charlotte is different.

Bobby Ward, 17, was the first to start flying. He was making $8 a week carrying the Charlotte *Observer* and selling free-lance pictures. That would pay for an hour a week in the Taylorcraft at Cannon Field. Stuart Shannonhouse, who has a brother in the Army Air Corps, watched with avid eyes and had an idea. He was 16, he made only $7 a week—not quite enough for an hour's flying a week—but since his mother was neutral and his brother helped "sell" Dad on the idea of signing the request for a student permit, Stuart began flying too.

The club was Stuart's idea. Neither boy was satisfied with the amount of flying they were getting. Dr. Garinger, principal of Central High, offered a school room for meeting; the YMCA would start a ground-school. If they could get a plane, costs would toboggan. There were three *Cub* trainers at Municipal and Cannon Fields for sale. If they could get four other boys, about $30 apiece would swing the down payment on one.

There wasn't much encouragement at home. Bobby would have to wait a year to be old enough for a license. Stuart would have to wait two years. Both had only the money they could earn after school. It simply did not seem possible that they could buy and operate a plane, but back at school the boys

(*Continued on page* 70)

Learning to fly even Army trainers like this BT-14 demands much from a young cadet . . .

ARE ARMY FLYING CADET

YES, *says* MALDEN G. BISHOP

This writer contends that wash-outs, running sometimes as high as 50 per cent per class, are not justified. Initial failures should be tried again.

Mr. Bishop, a FLYING and POPULAR AVIATION correspondent in California, interviewed many Army Air Corps wash-outs while gathering material for this article. He was assigned to discuss the situation with the Army wash-outs.—Ed.

THE U. S. Army Air Corps is out to train 12,000 new pilots this next year. Since about half the cadets who begin training are washed-out before they win their wings, this means more than 24,000 men will have to be enrolled as flying cadets. Since only one in 10 pass the physical examination after applying for training, some quarter of a million men will have to be examined.

When the Army goes to the trouble, time and expense of enrolling a young man as a flying cadet—investigating his record and qualifications, examining him physically, regimenting him to a primary training school, etc.—it has already begun spending the $15,000 it costs to train a pilot. And when the Army washes out the cadet in his third, fifth or seventh month, it has wasted a good many thousands of dollars.

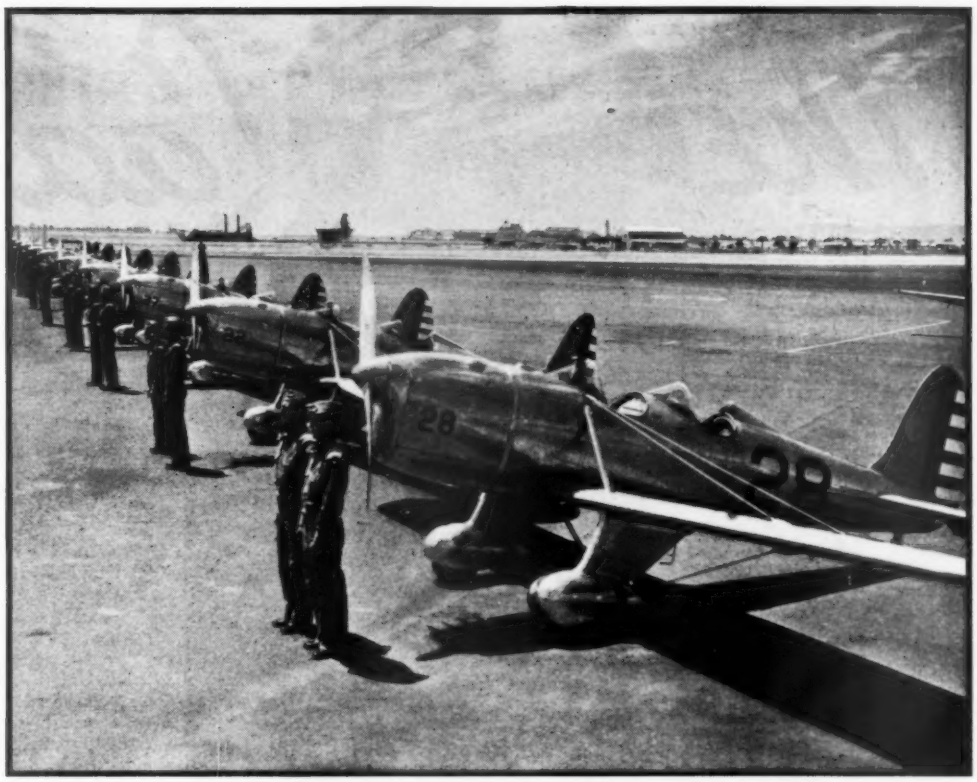
Those who have objected to being washed-out have received an official cold shoulder. Any who wailed about their dismissal were considered "sour grapers." The training had been given, the cadet had failed somewhere along the line, the die had been cast. In the best and official judgment of the Air Corps, the cadet was unfit and that was that.

However the war in Europe has suddenly focused public attention on the minuteness of our air force. A nation of 130,000,000 people with less than 6,000 military pilots is a shocking fact. Faced with the first job of correcting this condition, the Air Corps has rallied its resources and expanded its program to accommodate new thousands of cadets. The speed and efficiency with which the Air Corps has met the challenge has won the praise of scores of newspaper and magazine articles.

Nevertheless, there are new rumblings along the critics front of the Air Corps training program. The murmurs of the legions of ex-flying cadets are beginning to be echoed in public throats. Why are so many cadets washed-out? What's wrong with these young men anyway? No criticism is being made of the pilots the Army *does* turn out; it's the men who are being washed-out, the waste material which is beginning to demand attention.

Officially the Army gives its main reason for washing-out cadets as "an inherent inability to fly." An inherent inability to fly is assumed when a cadet shows a "lack of progress." A lack of progress is indicated when the cadet fails to solo, for instance, within the prescribed time; when he fails to make the right kind of landing or take-offs; when he fails to

(*Continued on page* 78)



Largest percentage of wash-outs come during primary training, on simple trainers . . .

STANDARDS TOO SEVERE?

NO, *says* FRANK LAMBERT

Years of careful effort toward the reduction of cadet wash-outs prove the Air Corps' stand on this problem to be wise, this author points out.

The author is and has been actively engaged in the training of flying cadets for the Army Air Corps for several years. He is well qualified to present the Army's experience with this question which is of such great interest today.—Ed.

THE problem of how to get a maximum number of well-trained pilots in return for the money, effort and equipment expended for instruction has been the subject of constant study and experimentation by the Army Air Corps for more than 20 years. The policies resulting from their studies have been widely publicized of late, but the experiences leading up to their adoption are not generally known.

These experiences began during the first World War. It was generally assumed then that ability to fly was simply a matter of courage and daredeviltry and that the enormous number of deaths occurring in training was a necessary consequence of the fact that flying itself was a dangerous thing.

Even at that early date, the men who were actually doing the training began to question the assumption that inherent ability to fly and the desire to learn to fly were necessarily related. They began to question the necessity of allowing brave young men to prove their lack of talent for flying by crashes so numerous that only a very small minority ever lived to reach the enemy.

Statistics began to pile up showing that some men crashed repeatedly while others, who had received the same or even less training, had almost no crashes at all. Other figures began to prove that, in general, the men who wrecked the most equipment and were the first to be killed in accidents were the men who had shown the least aptitude while in training.

Of course there were occasional exceptions, but the men doing the training were beginning to wonder whether, even in a time of emergency, it was wise to expend vital equipment and many young lives in the hope of discovering the few exceptions who might show a sudden improvement in ability if they survived.

During the twenties the Army flying schools were neither crowded nor rushed, so the instructors and check-pilots devoted much of their time to studies and experiments designed to improve their methods of instruction and also to discover whether or not the number of fatalities in flying, resulting from pilot error, could not be greatly reduced. In each of these efforts they succeeded remarkably well. There is a tendency to attribute improved safety in flying altogether to the improvements in aircraft and to forget that more accidents resulted from pilot error than from all other causes combined.

(*Continued on page* 56)

The Ladies DO THE WORK

Many girls become expert airplane welders. This girl is among the best at Akron Aircraft Co.

by Helen Waterhouse

Women have proved themselves capable and efficient aircraft workers in this plane factory. They will be especially valuable in such work in case of a national emergency, as the women of Britain and Germany have proved in this war.

THE fair sex is entering the aircraft industry in Akron in a real and vital way. Welding torches in hand, begoggled girls daily are standing in a shower of sparks before the work benches in the basement of the Akron Aircraft Co., where sport planes, powered either with an auto or aircraft engine, and designed by the Funk twins of Akron, are being built to the number of one or two a week.

Upstairs in the same building other young women sit on high stools before other tables filled with such tools as shackles and turnbuckles, splicing cables with practiced hands. In still other departments of the company pretty young girls in overalls squat on the floor, cutting out the felt for seat and back cushions and putting dope on wings. Still others sew and stitch the wings at sewing machines.

The girls all agree that there is no reason why women can't enter the aircraft construction field as well as the men. It's not dirty work, they point out, except on their hands and they like to be a part of a vital young industry where work is increasing daily due to the national defense program. They would rather work here than in Akron rubber shops, they say.

The 112th "Akron Aircraft" plane has just been delivered to its purchaser and the Funk brothers have dozens of cash orders ahead and are speeding up production as much as possible in the rather cramped space of their factory, which formerly was an Akron schoolhouse. On January 1 the company moved to larger quarters.

They have recently begun manufacturing a large part of their ships with Lycoming engines to meet a popular demand for air-cooled jobs.

"With larger airplane companies around the country hiring our expert men as fast as we get them trained, the fact that girls can do much of the work as well as the men employes is a vital factor right at this time," Joe Funk, one of the twins, declares. "After all we aren't far enough into production to be able to pay large

Cable-splicing is an important aircraft job being done by women at Akron firm.

Gladys Howell (right) is a veteran welder, having learned the trade at Fokker.

salaries and, of course, girls will work for less."

One of the girl welders—Miss Gladys Howell—is a veteran at the trade anyway, having learned the ropes of welding in the Fokker airplane plant in West Virginia. Clad in overalls and a sport shirt, Miss Howell is a businesslike figure as she holds the steel pieces, which later will go into the making of the plane, against the white hot flame. Pausing to pick up a small piece of metal which, she explains, is a fitting for fuselage cells, Miss Howell described the welding class which she and the other girls were obliged to attend before entering this business. The school was conducted right in the factory building.

"We went 40 hours in order to get our training," she said. "The main thing you have to have for welding, is a steady hand. You can't be a jittery person and do welding."

Miss Carol Trent, an Akron high school graduate who originally planned to be a commercial artist, is another of the girl welders. A pretty blonde, Miss Trent also stressed the fact that accuracy is the first requisite of the welding trade.

"If the pieces are not welded right, and are not even, they are sent back to us with a rejection slip," she said. "Everything, especially for a plane, must be perfect. You can't fool with airplane construction." Even Don Freshley, foreman of the welding department, has to admit that his feminine welders are as adept in the art as are the men.

Mrs. Gertrude Matthews, who splices cables, is equally as enthusiastic about her job. A former rubber shop worker, Mrs. Matthews, who says she has always been mechanically inclined, is sold on the idea of women working on planes. "It's a coming job for the feminine sex," she believes.

A veteran feminine worker in the factory is Mrs. Thelma Walter who is superintendent of the sewing room where the wing coverings are designed and made and upholstered cushions are fashioned. Mrs. Walter is especially proud of the fact that she has cut the time of making airplane wing covers about one-third, by using wider material and changing the design. "I draw designs for the wing covers just as you would draw a pattern for a dress," she explains. "The material we use is Grade A airplane fabric. After cutting the fabric, I double stitch it on the machine, making a folded flat seam such as the Civil Aeronautic's Board requires on all wing covers. I fold and sew the seam down all in one operation.

"When we go into heavier production, I cut more and make a larger number at one time. Sometimes, with use of a special knife invented by an Akron man just for the purpose, I am able to cut out 28 thicknesses of cloth all at once. I do my own inspecting of the finished product.

"One thing I insist on my girls realizing is that, if they do not do their work right, someone's life may be lost on account of their blunder. You can't fool around with airplane work or do sloppy work with parts of planes," she added. When the pieces of fabric all are finished in their required shape, Mrs. Walter marks

(*Continued on page 87*)

Naturally, women excel at cutting and sewing wing fabric for Akron aircraft.

The Gyromatic Navigator installed in a Fairchild (right) is between controls.

Inset below shows a close-up of new Lear device. It is built onto directional gyro.

GYRO GUIDE

by WILLIAM P. LEAR

It will be a difficult matter to get lost in the air with this new instrument in your plane. The device's designer tells you why.

IN the 10 years of my active work in aviation it has been my good fortune to be associated with the development of several important new devices for radio navigation of aircraft. None of these gave me as much satisfaction or as much sense of worthwhile accomplishment as did the development of our Gyromatic Navigator, which was perfected by us last year after many months of experimental and research work.

We started with the idea of producing an automatic radio direction-finder which would permit straight-line radio navigation of aircraft under unknown and varying drift conditions. We succeeded in developing such a device by combining in a single instrument the correlated indications of an automatic radio direction-finder and a directional gyro. But, after we got through with our flight tests, we found that we had in our Gyromatic Navigator a new discovery rather than a new invention.

It did all we had expected—and far more. We were elated to find that the new instrument gave us a running graphic solution of many difficult navigational problems which were heretofore considered insoluble.

Since then many pilots have flown with our instrument, in many types of aircraft, under many diverse operating conditions. All have been unanimous in their praise. The technical press has hailed the Gyromatic Navigator as "the new basic instrument for radio navigation of aircraft." And that is precisely what it is.

The device combines the separate indications of an automatic radio direction-finder and a directional gyro. It integrates these indications with reference to the airplane's heading and automatically gives the pilot his position with respect to (a) his destination and (b) his desired track. The instrument literally plots the

problem and gives the solution—not once in a while, but continuously. It faithfully records the ever-shifting position of the airplane with respect to its heading, the ground references and the desired track. The entire navigational problem *and its solution* are graphically shown on a single dial.

The Gyromatic Navigator gives all indications of an automatic radio direction-finder as well as a directional gyro. In addition, it combines these two indications in such a manner that the pilot can do straight-line navigation along any desired track, either towards or away from a radio transmitting station, under unknown and varying wind drift conditions, without visual references outside the airplane.

Many other navigational problems are easily solved with its aid. For example, a pilot can orient himself with its aid by taking cross bearings to establish his position fix, and then fly a straight-line course to any destination *not* provided with a radio transmitting station. One of its most important applications is in instrument landing, using the familiar Army-Hegenberger system. With the Gyromatic Navigator, all that the pilot needs is only *one* non-directional radio marker on the prolongation of the desired runway.

In military or commercial operations, on land or at sea, the Gyromatic Navigator finds many uses, by automatically providing a swift solution to tricky problems. If this brief description of what it can do seems at first glance overly enthusiastic, you must remember that it is hard for any man who has flown with the Gyromatic Navigator to speak of it otherwise. Just consider its simplicity of construction, ease of operation and versatility of performance under everyday or unusual flying conditions.

For sake of comparison, take any automatic station-seeking radio direction-finder. When you tune in on a transmitting station, the indicating pointer on the 360° dial automatically swings to show the true direction of the incoming signal. There are several such direction-finders now on the market—including one built by our company—and they all work about the same way. The pilot tunes in the radio station on which he wants to take a bearing and the station-seeking loop outside the airplane automatically turns until it faces the incoming signal. The loop is connected through a drive shaft to the indicating pointer which moves against an azimuth scale divided into 360° and shows the station's bearing.

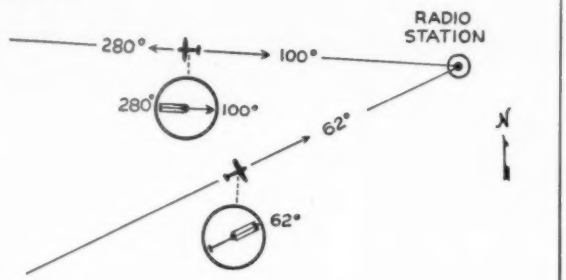
William P. Lear

For ease of navigation, the 360° dial scale is usually made rotatable so that the pilot can set it against the lubber mark on the instrument case in such a

(*Continued on page 72*)

Diagrams below, prepared by the author, illustrate points referred to in this article.

FIGURE 1



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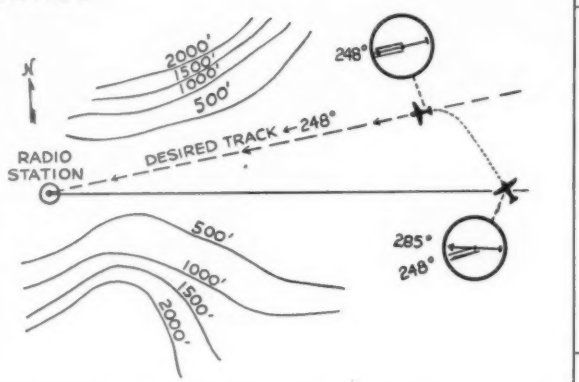

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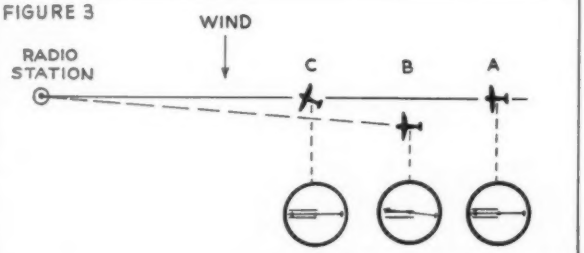

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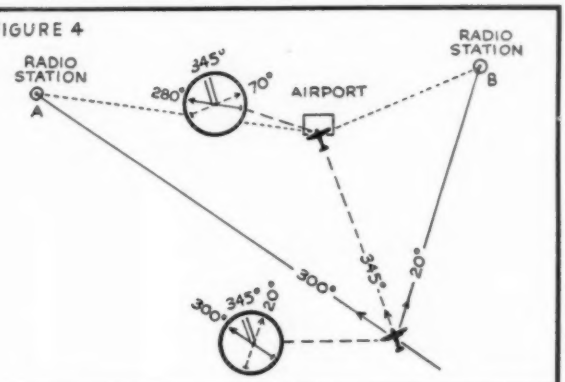

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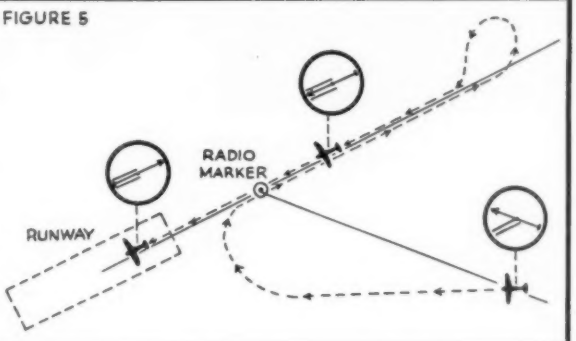

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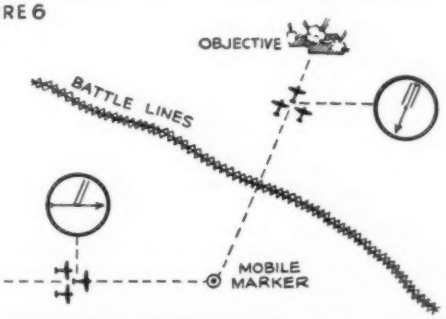
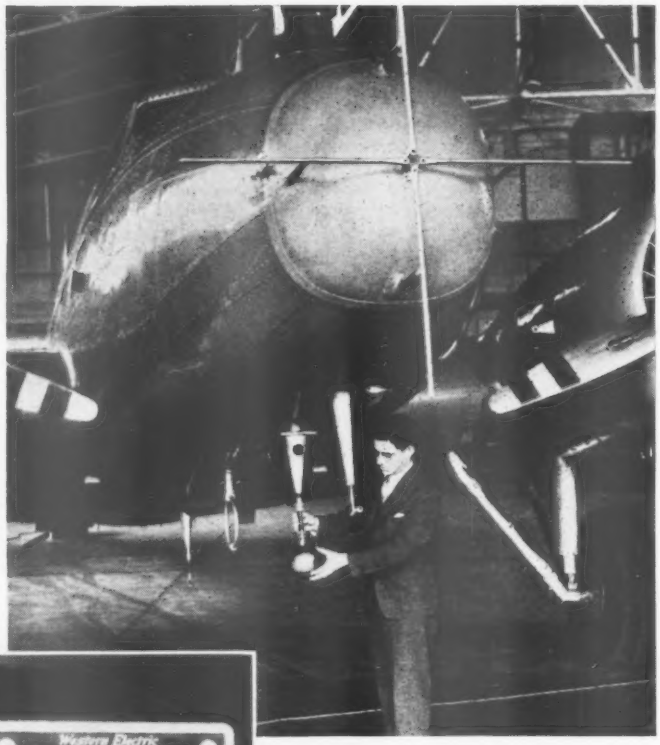


ULTRA-HIGH FOR THE FUTURE

by DeWITT WENDELL

The airlines are getting ready for a new radio system that soon will eliminate many of today's problems.



United Air Lines used its "flying laboratory" for many static research projects.

In an effort to cut down static, United Air Lines devised this discharge wire.

Among first finished ultra-high equipment is this Western Electric marker receiver.

THE whole aeronautical radio picture in the United States is due for a radical change within the next five years, unless the war puts a brake on plans that already are maturing in the Civil Aeronautics Board. These are for a coordinated and properly engineered system of airways and a weather and "homing" grid to cover the entire nation under a scheme that takes into consideration national requirements of aviation as it is now and as it probably will be in the immediate future. The program is the joint creation of CAB engineers and of the commercial airlines' radio advisory committee.

The ragged system of airways that now exists, the loose weather networks now operating, the poor choice in radio wave lengths or frequencies that are used today all will be changed. Ultra-high frequency will replace the long-wave radio beam stations now used, the number of frequencies necessary will be reduced from 150 to 20 or 30. Instead of getting weather from radio beam stations, all weather will be handled by long-wave transmitters of enormous power that will blanket the nation in a gridiron of clear channel stations able to blast through all static.

These same weather-grid stations will be available for "homing" use by private, commercial, military or governmental aircraft. Approximately 25 will cover the entire country from north to south and east to west at intervals of about 500 miles. Meanwhile the airways will be straightened out like modern highways—so that they will miss the main cities and traffic centers. Lead-ins to these traffic centers will provide the airlines with access to the great commercial airports such as New York's Long Island field, Chicago's big double-runway municipal airport, Kansas City's terminal and others. And private traffic will be able to stay right on the airway, passing these busy airports by.

Specifically the program's ultimate realization may depend upon findings made during the latter months of this calendar year of 1941. The testing ground will be the ultra-high frequency radio airway between Chicago and New York that is almost finished and ready for operation. Sites for eight ultra-high frequency transmitters have been bought and buildings erected thereon. Most of the stations will have their new radio equipment installed by the time you see this and airplanes of the big three—United, American and TWA— will be using it, receiving the ultra-high frequency signals through new-type radio receivers that now are being installed in their aircraft.

Why, you may ask, change a system that already is working and seemingly working pretty well? Why spend the money to build a new system of airways radio aids, why cause a discarding of all the expensive radio equipment that already is installed in the Army, Navy, commercial and many private airplanes and a purchasing of newer and equally expensive equipment to receive the high frequency signals?

There are many good reasons. The existing system of airways and radio beam stations, like Topsy of Uncle Tom's

(*Continued on page* 60)

ALL-OUT DEAD RECKONING

by LIEUT. T. C. GILLMER

Of vital importance to any pilot is his ability to navigate his plane out of a dangerous situation by dead reckoning. Here is a discussion of certain aspects of this procedure.

THE present day performance of aircraft, together with increasing demands on both pilot and aircraft, is pinning a heavy personal responsibility on every pilot. Particularly so in his ability to cope with requirements demanding precision thinking and quick, accurate decisions. In the larger aircraft and those of military purpose, the large burden is shared among the crew. Nevertheless the captain or first pilot is not relieved of any final responsibility. Among other items, a greater portion of these burdens concerns problems of navigational character; range of action, alternate airports, locating position in instrument weather, etc. In smaller aircraft, of course, the pilot shares his problems with himself

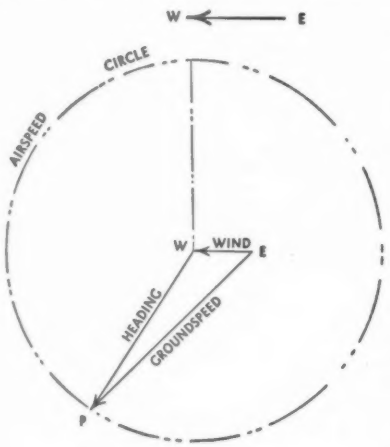


Figure 1

and the navigational element is of little less importance.

Maintaining safe and efficient flight and the other work of non-navigational aspect creates a demand for quick and, often, near-mechanical solution of the navigational problems. Together with the recognized mental lag due to altitude, the pilot must have his methods pared down and simplified to the barest working elements. It is not excusable for him, on the other hand, to neglect any preparation for these moments in the air when the propeller is absorbing miles of gasoline and he gropes for a solution. The theory behind the calculators and computors must be thoroughly studied and mastered in order that they may be made "to talk" and, more important, to be confidently trusted. After all, no mechanical means of solution is any better than the manipulator.

Short of the realm of celestial air navigation the solution of radius of action is popularly believed to hold a great many pitfalls. This is an unfortunate consideration in that it worries, and in some cases causes a shying away from the last and most important phase of dead reckoning navigation. Because radius of action combines every feature of dead reckoning in its particular parts and embodies such a great range of uses that it is the complete assembled machine of air navigation. The airline pilot with his alternate airport, a Naval pilot intercepting a carrier, a military pilot scouting an objective, all face this same problem. Nor are its uses limited to the field of larger or military aircraft; a private pilot on a Sunday afternoon will sooner or later come face to face with it (whether he knows it by name or not), wondering if he has enough gas to get home.

The fears of involved theory may, like a great many others, be brushed aside by repeatedly bringing it to light. The actual working solution may be cut down to very practical elements. In this light let us consider:

First, Radius of Action may be divided into two classifications: (1) fixed base problems; (2) moving base or alternate airport problems. Both of these classifications embody the following elements in common. (1) solution of the wind triangle, for drift or heading and groundspeed; (2) the application of the formula for obtaining the flying time before turning.

It is assumed that the pilot is proficient in the solution of wind drift. However, in passing, a few pointers might be mentioned that may facilitate or mechanize this operation to the point of highest efficiency.

The designations E, W and P have been used for some time in military aviation and in some private ground schools.

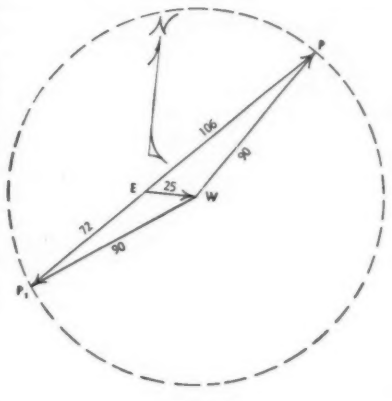


Figure 2

Their application, however, does not seem to be widely enough recognized, and their full value in making a rapid, fool-proof solution is just beginning to find popular acceptance. The three letters in their three combinations make up the three sides of the wind triangle as follows:

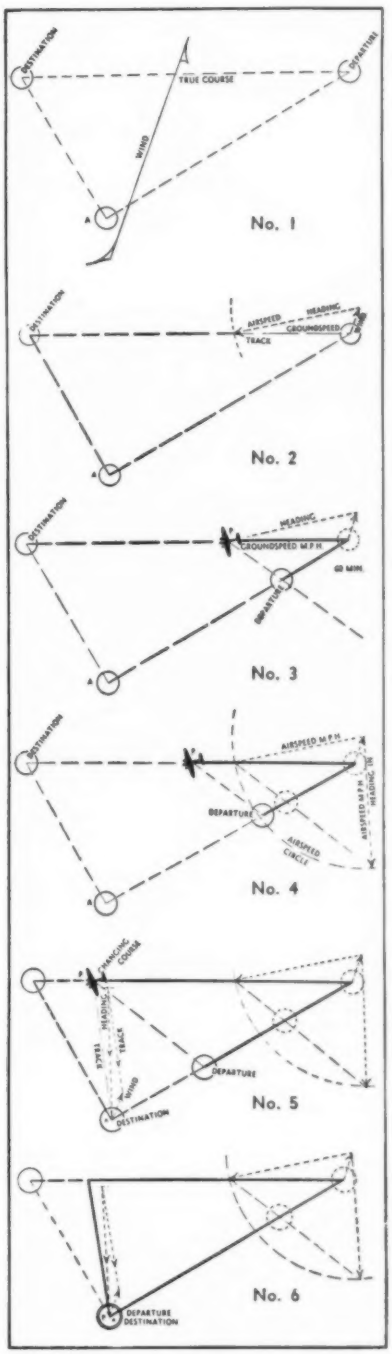


Figure 3

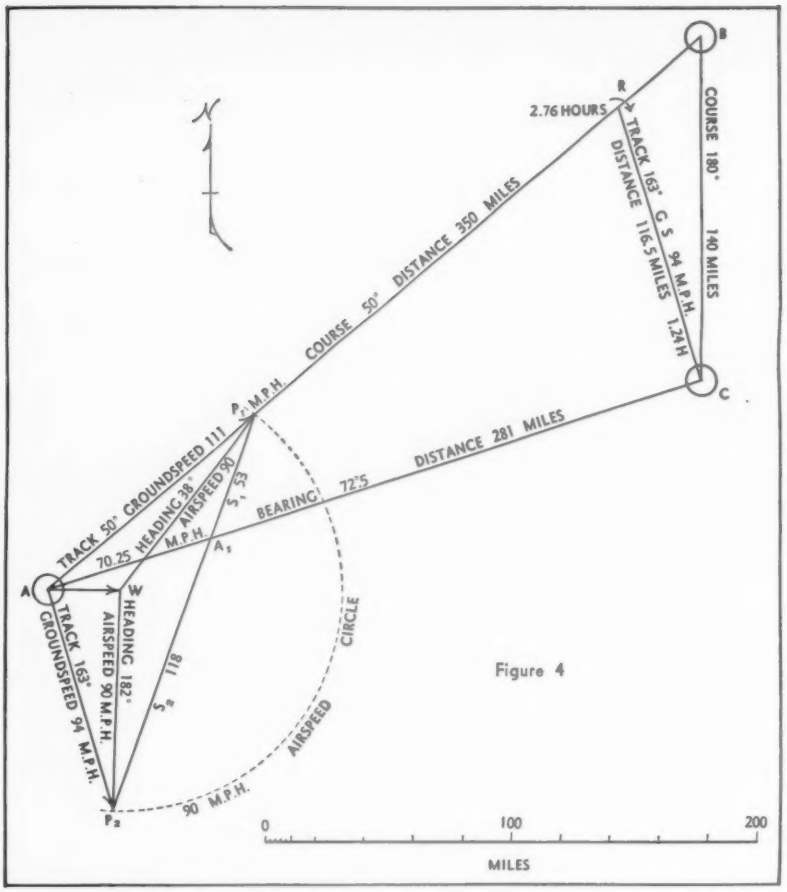


Figure 4

E → W = Wind speed and direction
E → P = Ground speed and track
W → P = Air speed and heading

They are self-explanatory in that E stands for Earth, W, wind; and P, plane. E → W, then, implies wind relative to the earth or its true speed and direction. E → P, likewise, signifies plane's motion relative to the earth, or the ground speed and track and W → P, the plane's motion relative to the wind or the air speed and heading.

In using them to lay out the wind triangle, it is extremely important not to reverse their order. For example, the heading and airspeed can only be W → P and not P → W. The best practice is to work from point W first and establish an air speed circle which in most cases is a known value. The remaining values may then be easily and automatically determined by establishing the other points (Figure 1).

Example:

Given: Wind = east 30 m.p.h.
True course or intended track = 225°
Air speed = 90 m.p.h.

Find: Ground speed and heading to make good this course.

Note: If the wind is east 30 m.p.h., this establishes the length and direction of line E → W. Track = 225 establishes the *direction* of line E → P. Air speed = 90 m.p.h. establishes the *length* of line W → P.

Solution: (1) Plot E → W to any suitable scale 30 units long and from the direction of 90° true (east). Thus: W ← E.

(2) With W as a center, swing circle with radius equal to air speed (90 units). Point P is somewhere on this circle.

(3) Plot track from point E. Where it intersects the air speed circle mark point P.

(4) Read ground speed and heading as direction of WP and length of EP respectively.

A solution as shown above is invariably the first step in any problem involving alternate airport or radius of action. In other words, it is the solution of the proper heading to make good the desired track and the ground speed leaving the point of departure.

In the second step of radius of action, we must consider whether the problem is fixed or moving base. That is, whether it is desired to return to our point of departure or some other point. First, as mentioned above, the solution of both problems is based on the same fundamental formula. In order to understand this formula, let us briefly develop it in relation to a problem involving fixed base. This will be effective whether a private pilot desires to know how far away from home he can fly and still return with a limited fuel supply or whether a military pilot desires to know how much time he can take to make a flight to his objective and return to base.

Let the factors involved be represented as follows:

T = total flying time.
t_1 = flying time out from base.
t_2 = flying time back to base.
R = radius of action or distance out before turning to fly back.
S_1 = ground speed out.
S_2 = ground speed back.

Development:

(1) From the above, $T = t_1 + t_2$

Total time = time out plus time back

(2) then, $t_1 = \frac{R}{S_1}$

$$\text{time (out)} = \frac{\text{Distance}}{\text{Speed (out)}}$$

(3) likewise, $t_2 = \frac{R}{S_2}$

R being the same (distance out = distance back)

(4) Adding (2) and (3) we have,

$$T = \frac{R}{S_1} + \frac{R}{S_2}$$

$$\text{or, total time} = \frac{\text{Radius of action}}{\text{speed out}} + \frac{\text{Radius of action}}{\text{speed back}}$$

(5) the above expression cleared for R results in:

$$T = \frac{R\,(S_1 + S_2)}{S_1 \times S_2} \quad \text{or} \quad R = \frac{T\,(S_1 \times S_2)}{S_1 + S_2}$$

$$\text{Radius of action} = \text{Total time} \times \frac{\text{Speed out} \times \text{speed back}}{\text{Speed out} + \text{speed back}}$$

Or if radius of action is desired in terms of time, it is simply deducted as:

$$t_1 = \frac{R}{S_1}$$

$$\text{time before turning} = \frac{\text{Distance out}}{\text{Ground speed back}}$$

After a pilot assures himself of this development it is necessary only to keep in mind the final formula (5). Such development will serve him well if kept in mind in event of memory lapse.

To demonstrate a solution of a fixed base problem in practice, let us consider this brief example: let us say that it is desired to fly out from an airport toward a distant city that lies on a true course from the point of departure of 45°. The wind is west, blowing 25 m.p.h. Our plane can cruise at 100 m.p.h. true air speed; how far can we fly on this course before turning back if our fuel supply is good for 4 hours, 15 minutes, allowing 15 minutes' safety margin?

Solution: Our ground speed out and back first are determined by plotting the two wind triangles according to the procedure set forth above (Figure 2).

These are determined to be $S_1 = 106$, $S_2 = 72$

With the formula then,

$$R = \frac{T(S_1 \times S_2)}{S_1 + S_2}$$

(Continued on page 80)

I LEARNED ABOUT FLYING FROM THAT!

NO. 23

by

Gus Doppes

Towing banners is a tricky business in which there is no room for carelessness, as this airman found out.

"In towing banners you usually keep as low as good judgment permits so that everyone can look at the advertisement. This banner was about 50 feet long."

THERE is an old saying that anything is easy after you know how—it should have added that most experience comes from plain blundering.

It was just after I started flying banners — you know, one of those long streamer-like cloths that are towed behind a plane to advertise some particular product. It was a pretty good-sized banner, being about 50 feet long, seven feet high and with about 250 feet of tow rope to separate it from the plane. I had watched other pilots tow them hundreds of times and it was as simple as A B C—or so it seemed.

Before the take-off, the banner is stretched as far out in front of the ship as the length of the tow rope and banner will permit with the ship headed naturally into the wind. It is placed slightly to one side so that when the plane takes off the rope and cloth will not foul the plane. The take-off is done in the regulation manner except that when you once are in the air you pull the plane up sharply to jerk the banner clear of the ground to keep it from dragging and killing flying speed. All this was elementary to me as I had been instructed and had watched the operation often enough to have it down pat.

Everything went along fine. With an empty ship and plenty of horsepower, the plane practically leaped into the air when I gave it the gun. I pulled the ship up sharply as I dared and the banner jerked off the ground like a kite and I was off. . . .

In towing banners you usually keep as low as good judgment permits so that everyone can get a good look at the advertisement on the banner. The heavy drag of the banner on the plane has to be compensated for, so I wound the stablizer into full "up" position and went on my way, thinking no more about it. This nearly caused my untimely finish, had not another unexpected event occurred to forestall it.

After covering the beaches, ball parks, amusement parks and the like I headed back to the field to drop the banner. Circling the field I came in downwind, as all I was going to do was drop the banner, make a half turn and land. In dropping the banner I always came pretty low, down to 10 or 15 feet so the banner wouldn't flutter off over anybody's property; they can be a whole lot like a chute in this respect. I was right down to the ground ready to drop the thing when I noticed the crowd that is proverbially gathering at airports on Sundays. I decided to give the advertiser his nickel's worth.

I decided to fly along the length of the field before the crowd and automobiles. I realize now that this action was as much for showing-off as it was in giving the advertiser a few extra seconds of time, but that is beside the point. At the far end of the field there was a road and across the road was a 10-foot wire fence that enclosed a private estate Directly over the fence were the inevitable wires but, as I had flown over them thousands of times, I was not particularly concerned. I decided I would drop the banner just before I reached the end of the field and, that way, it would be easy to recover and at the same time be out of the way of other ships. Then I would pull up over the wires in a grand flourish, I suppose. . . .

I dragged the whole length of the field with one eye on the fence and the other on the wires. As I approached the end I reached for the release trigger to drop the banner. I gave it a good tug and waited for the spurt of speed which would tell me it had dropped. I waited in vain; the banner didn't drop! I gave two more desperate tugs and gave it up and turned my attention to the fence and phone wires that were rushing to greet me!

Gus Doppes

I had run completely out of airport by this time and to make things worse the juicy problem of how to get the banner over those wires presented itself to be solved immediately. There was no room to fly between the top of the fence and the lowest of the phone wires. I was faced with a desperate choice: hit the fence or try and pull up over the wires? I realized I might possibly pull the plane up over them but that the banner would not pick up the same height the plane did until it had covered considerable more distance. If I pulled up it was bound to tangle in the wires. The tow

(*Continued on page 87*)

The legendary Snake River flows past the rear of the Zimmerly hangar at Clarkston.

Mountain Flyer

by J. Clarence Moore

Bert Zimmerly will fly you just about anywhere in the Rockies. He is the kind of a pilot who helps to keep aviation the adventurous business it is. Many owe their lives to his abilities.

THE call came in at 9:30 in the evening. It was the supervisor of the Nez Perce National Forest at Grangeville, Ida., asking Bert Zimmerly to fill a difficult flying assignment—something that is not uncommon in the everyday life of this Clarkston, Wash., flyer.

A Forest Service ranger, bitten by an infected tick, had been stricken with the deadly Rocky Mountain spotted fever. Time was at a premium if his life were to be saved. Air ambulance was the only solution, but Zimmerly soon learned that getting an airplane to the man would be the problem.

The ranger was at Horse Heaven Lookout in the Seven Devils Mountains, those spectacular peaks which border the nation's deepest gorge, Hell's Canyon of the Snake River. No airport there—only a bare slope on which the supervisor thought Zimmerly "might" be able to land, though it had never been attempted before. Zimmerly asked the dimensions of the field. "It's worth a try," he decided.

He took off before dawn in a Travel Air 6000, the all-purpose ship he uses for ambulance work, scheduling the trip to arrive at the lookout station just as soon as the sun provided sufficient light for a landing. It still looked like a tough assignment when he arrived. The meadow was only 1,000 feet long, with a 20 to 30 per cent slope. Further complicating the task was the fact that the field was at an altitude of 8,200 feet and Zimmerly would have to maneuver his plane in rarefied air.

The pilot flew about the meadow for several minutes, checking the accuracy of the dimensions, the character of the ground and the slope. He finally decided he could do it. He cut the motor and glided in. The wheels touched the ground at the edge of the meadow and then the heavy ship swooped up the grade, rapidly eating up the length of the short field. Brakes on, it slowed. But the boulders at the end of the meadow loomed close. Zimmerly had a few anxious moments. Then he lugged the Travel Air to a stop but 50 feet from the end of the meadow and the rocks—against which, had his judgment been faulty, it could have been destroyed.

The stricken ranger was loaded into the plane and flown out of the rugged country to a hospital. He has Zimmerly to thank that he is alive today. Not many recover from spotted fever. To people of the mountain states there are few worse scourges.

Such tasks as that ambulance trip fall naturally to the lot of Bert Zimmerly because of the character of the country in which he operates. From his port at Clarkston, across the Snake River from the sister city of Lewiston, Ida., he is called upon to make many trips into Idaho's vast primitive area, flying for great distances over mountainous country, reached otherwise only by trails. Nowhere in the nation is there so large a primitive area that has such ruggedness and variations in altitude to plague pilots.

Much of the remainder of the district tributary to the Clarkson airport has a jumbled terrain, the natural barriers of which isolate many places and make them readily accessible only by plane.

On regular charter trips to Boise, Idaho's capital, Zimmerly must fly for 140 miles up the tortuous grand canyon of the Snake, where landing places are few. Occasionally, to escape storms, he has dropped far down into the narrow and rocky vault of Hell's Canyon. The Seven Devils peaks, which he passes 110 miles out en route to Boise, are also a frequent destination when people want to make scenic flights.

Bert has even been called upon to land in the canyon itself. When he goes in to Johnson's bar, 100 miles south of Clarkston on the Snake—as he has done on ambulance or more routine trips—he glides down into a maw, the bottom of which is more than 5,000 feet below the surrounding mountains. For ranchers there, whose

Injured in a mining accident deep in Idaho, this elderly man was flown to hospital by Zimmerly.

only other means of reaching civilization are a long, arduous trek afoot or a day-long ride on the mail boat which reaches them only once a week, Zimmerly provides a real service. Knowing that when wives or children become suddenly ill, they can be flown out of the canyon, these ranchers have less qualms about living there throughout the year.

People in the Wallowa Mountains of Oregon are others who depend on air ambulance service. From isolated Grouse Flats, Bert Zimmerly one day brought a woman suffering from severe nasal hemorrhages. He had to land on a mixture of mud and snow in a stubble field and had considerable trouble in getting the ship off. The patient's rancher husband credits him with saving her life.

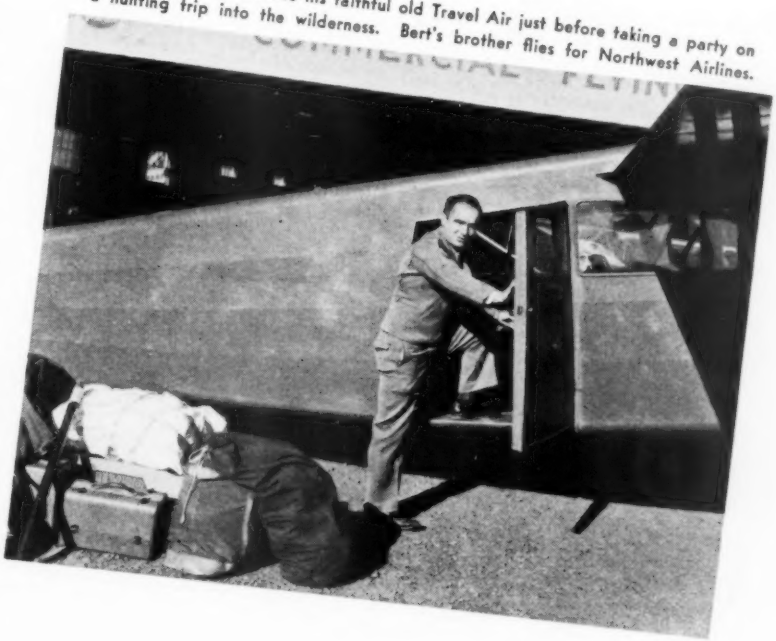
Two Zimmerlys, Bert and Fred, began their commercial aviation career in 1934, when they opened a flying service at the Lewiston municipal airport. Their first equipment included a seven-place Zenith and a Student Prince trainer. They rapidly adapted themselves to the type of aerial work demanded in the tributary territory and expanded steadily. In 1938, the Zimmerly Brothers Air Transport, the name it retains today, moved to the new and more commodious Asotin County airport at Clarkston. Two years ago, Fred became a transport pilot for Northwest Airlines out of Seattle, Wash., and, except for vacations and periodic leaves of absence, he has left the active operation of the firm to Bert.

This stocky older brother, who reacts to mention of his exploits with a deprecating boyish grin and a sparkle from his brown eyes, has in recent years carried out some unusual work, some of which scored firsts or near firsts in the aviation game.

One of these was the "bombing" of the primitive area with salt for wild game. Normally, to carry the salt to the wild country Forest Service or Idaho Fish & Game Commission employes must make long trips with pack strings. In the spring of 1938 the commission decided to experiment with the dropping of salt from the air. The contract was given to the Zimmerlys and, with loads of salt aboard, Bert flew over the primitive area, swooping down to within a few hundred feet of selected spots in the rough and timbered country to unload this vital necessity for elk, deer, mountain sheep and wild goats. The bags broke as they hit and the salt did not scatter. The experiment thus ap-

(*Continued on page* 64)

Bert Zimmerly climbs into his faithful old Travel Air just before taking a party on a hunting trip into the wilderness. Bert's brother flies for Northwest Airlines.



The Bush Flyers Carry On

This is Canadian Airways' Junkers Ju-52 freighter, CF-ARM, popularly known to bush flyers as R-M.

by Morton L. Bennet

The war doesn't mean much to the Canadian bush pilots. They are thrilled by the deeds of their younger comrades, unaware of their own bravery.

THOUGH Canada's fighting pilots are keeping up the tradition of Canadian airmen in the first great war, their brothers at home engaged in the more or less prosaic task of commercial aviation still continue to furnish headline material.

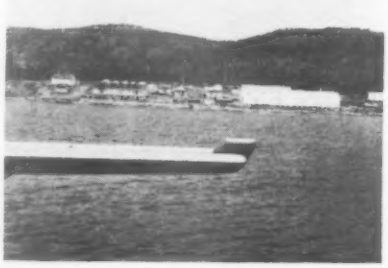
Age makes no difference to the bush flyer. At least two of Canada's outstanding bush pilots are at the 55-year mark and the majority of them are nearing 50. They read about the youngsters in the *Hurricanes* and *Spitfires*, scan their ever-widening waistlines and sigh. Then they return to their "colorless" task; a job of work that means moving hundreds of tons of freight in to new mining ventures.

The latest exploit of these men starts at Beauchene, northern Quebec, where the Atlas Construction Company dumped more than a thousand tons of equipment that they wanted carried in to Lake Manuan, about 160 miles northeast of Roberval, where they were going to construct a storage dam for the Aluminum Company of America. The equipment consisted of Diesel-powered shovels, tractors and bulldozers. None of these powerful machines could be dissembled into parts that could be easily handled. Several of the parts, when stripped to their last bolt, weighed more than 4,100 lbs. each.

Five airplanes, one of them R-M, Canada's "flying box car," swooped down on Beauchene and began hustling freight in to Manuan. Derricks lifted the weighty parts through opened loading hatches and airplanes staggered into the air with a minimum of gasoline and maximum load.

This, to the bush flyers, was routine stuff. Farther west, a couple of thousand miles or so, a sister fleet was rushing a shipment of 30,000 gallons of fuel oil in to a mine site. Not so far from there another ship was carrying ore cars and dynamite. Coming down from Aklavik were still more company planes carrying cargoes of furs worth a king's ransom. There was nothing romantic or colorful in carrying freight. But in this particular contract there happened to be a certain type of freight that had not yet been carried on Canadian Airways planes. When one considers that northern air freight manifests embrace baled hay, barbed wire, cement, tennis balls, live wild animals, fish (dead and alive), dynamite, cream puffs and tar paper one is justified in wondering what this freight is apt to be.

More than 1,000 tons of equipment was dumped at Beauchene to be flown inland.



In this case it happened to be several heavy draft horses. They were not dainty, high strung, comparatively light, race horses, but huge, bulky Clydesdales with dispositions not improved by the sight of the strange winged machine and prospects of an aerial journey.

Rod Grattan, pilot of R-M, scratched his head when he heard of this part of the charter. The only precedent he had to work on had been furnished by "Red" Lymburner, pilot of the Lincoln Ellsworth Antarctic Expedition, who had flown a team of oxen in from Oskelaneo to the Consolidated Mining & Smelting plant at Dore Lake. Red had made no bones about his job. Oxen were just so much freight to him. He had roped and thrown the animals and then wrapped them up in tarpaulins. They had been skidded aboard the Fairchild Super and the rest was aviation history.

But, Grattan reflected, oxen were docile animals. They didn't care what happened to them as long as they could lie down to it. If these horses could be doped to keep them quiet it might be a simple matter. The owners of the horses refused to agree to doping their animals. They had, they said, a man who knew horses from the ground up and he could control

(*Continued on page* 85)

Want a Job?

by HURD BARRETT

THIS month, for the benefit of those who have missed the earlier columns, we're going to summarize briefly the material we've covered in the first four installments. This will enable readers who want information on specific jobs to determine in which issues of FLYING AND POPULAR AVIATION, if any, their particular cases have been covered.

In the first installment, in December, we covered general pointers on how to go about getting a job and gave a job analysis on aircraft riveters' helpers, which is the basic starting job in an aircraft factory for mechanical help. We also touched on the problems of older men and on the types of work to which they are best suited. . . . In the January issue we investigated the reasons why most trade schools will not give credit to students beyond the term of their actual training and also explained that many public high schools give specialized aircraft training which is free. There were some rather important data given on the CAA, and NYA training projects. Letters from men who were looking for technical or statistical work were answered and a job analysis was given for the work of a detail draftsman. . . . In the February issue we covered machinists—although not intensively—and answered a number of specific inquiries on such subjects as painting, drafting, electrical work, welding, aircraft sheet metal hand-forming, sheet metal machinery operation and positions for women in aviation work. . . .

In March we quoted a statement by the Los Angeles Chamber of Commerce on employment in aircraft factories in Los Angeles County and ran a job analysis on a clerical worker who would be theoretically well adapted to a beginner's clerical job in any one of a number of branches in the industry. We also went into welding a little bit more thoroughly and touched on the lightplane manufacturing industry. . . .

* * *

Incidentally, since last month, the Los Angeles Chamber of Commerce has issued amendments to its pamphlet of March 28, 1940, which we quoted last month. . . . The present situation is still substantially the same as regards employment in Southern California aircraft factories, except that it is somewhat easier for *native* semi-skilled workers to get jobs. There are, however, certain classes of skilled labor which are at present in demand—and which the various manufacturers will interview by mail. Since this list will doubtless be changing constantly we suggest that, for the latest information, anyone with special mechanical skills—toolmakers, loftsmen, graduate aeronautical engineers, etc.—write for this bulletin to the Aviation Division, Los Angeles Chamber of Commerce, Chamber of Commerce Building, Los Angeles, Cal. Refer to "Bulletin on Conditions Affecting Employment in the Los Angeles County Aircraft Manufacturing Industry." A three-cent, stamped envelope should be enclosed. . . .

* * *

With but a few exceptions, the letters received from readers seem principally concerned with jobs in the manufacturing field; many readers ask us to give the addresses of the principal manufacturers, or to recommend schools. We cannot, as we have said before, recommend any trade school by name. Here, however, are the locations of a few of the manufacturers: in Buffalo, N. Y., are Bell and Curtiss-Wright. In Long Island City, N. Y., is Brewster. In Baltimore, Md., is Martin. In Seattle, Wash., is the Boeing company. In Los Angeles and vicinity: Douglas at Santa Monica, North American at Inglewood, Vultee at Downey, Northrop at Hawthorne and Lockheed at Burbank. In San Diego Cal., are Consolidated and the Ryan Aeronautical Corporation.

* * *

M.J.T., of the U. S. Marine Corps, asks for information on what a master mechanic's course from a good trade school will do for him. The term "master mechanic" has several connotations. Some of these courses lead to a C.A.B. certificate as an airplane or engine mechanic. Such certificates will naturally do a great deal toward placing a man. Line mechanics and flight engineers, for instance, must be certified. In other cases, such courses are known as "vocational courses", which give excellent, all-around training in most of the types of mechanical work that are done in the factories and in airline maintenance—and, hence, will equip a man to step into any one of a number of different jobs, both in manufacturing and with the airlines. In general, it is safe to say that if a man takes such a course from one of the recommended schools he stands an excellent chance of getting a good job with steady employment. Such courses, since they are so complete and run over a period of perhaps 12 or 18 months, are not inexpensive and should be taken only if a man is able comfortably to afford them. Often, with less complete training, a man can get employment at a specialized job which will enable him to finance and undertake part-time vocational training in whatever specialty he wants to follow as a career. In connection with this master mechanic's training, we have been asked how the Army and Navy men rate with employers. The answer is "tops."

* * *

Several men have written in who have had considerable experience in commercial photography. Aside from the strictly flying end of aerial photography there are many places within the industry where good photographers will find a ready acceptance. Almost all manufacturing companies have photographic departments where pictures are taken of various processes within the plant, with the view of preparing manuals for the instruction of employees, customers, sub-contractors, or the Army and Navy, in the servicing and assembly of aircraft. Such photographs are also used for publicity purposes. Men who can do first-rate color photography are particularly useful in the publicity end. Airlines go in rather more heavily than manufacturers for this type of exploitation. It must be remembered, in all this, that the field for photographers is necessarily limited, inasmuch as two or three photographers can do all the work for a major manufacturing company which may employ 10,000 or 12,000 men.

"Hey, Joe! Not that one! This one! . . ."

G.C. of Downingtown, Pa. writes, asking about work for partially trained engine mechanics. He states that he has had a year's experience on various engines, extending from 40 h.p. Continentals to Pratt and Whitneys. He has not an aircraft engine certificate. . . .

This latter fact should not be a great handicap to him. Most of the manufacturing companies and some of the airlines employ men on engine work—principally for installation and overhaul—who do not hold engine certificates. These men, of course, work under the direct supervision of certified engine mechanics. Men who have had a good basic experience with aircraft engines, or even highly skilled and experienced automobile mechanics, should be able to land some kind of a job working with aircraft power plants.

Speaking of experienced automobile mechanics, such mechanical experience offers a wide range of skills from which a prospective employer may choose. Most such mechanics are rough welders, can braze and are sufficiently skilled to work, for instance, as aircraft metal fitters. Some expert body and fender men can qualify as aircraft hand-formers and sheet-metal men. Almost all good auto mechanics have an excellent idea of how machinery is put together and can be useful in any one of a dozen manufacturing, installation or assembly operations, particularly if they are really good at reading blueprints. Others, who can run machine tools, can qualify for some type of work in an aircraft machine shop. And it shouldn't be forgotten, by people looking for work in a machine shop, that there are literally dozens of independent shops near the larger aircraft manufacturing centers that do sub-contractors' work for the larger manufacturers, in the machining of such items as castings, forgings, pulley-brackets, hydraulic cylinders, etc. A would-be machinist would do well to contact such people.

* * *

We are getting tired of reiterating this, but letters still are coming in from people asking advice on whether or not they should quit lucrative employment in other lines to go into aviation work. The answer still is NO! Again, for the record: if you have a job and are making a living at it, *don't* toss it up on the off-chance of getting something better in aircraft. The chances are that you won't . . .

* * *

W.H.S., Winifred, Mont. The names of some first-line engineering colleges where a degree in aeronautical engineering can be secured are Georgia Tech, Massachusetts Institute of Technology, California Institute of Technology, University of California, New York University and the University of Michigan. There are many others.

* * *

J.E.D., Indianapolis, Ind. Electricians are used in both airline and manufacturing work. Particularly in the latter. Electricians are of two types. Maintenance electricians are used to install electrical equipment such as lights, power

(*Continued on page* 68)

Doors Mixed?
Sirs:

. . . Why is Douglas making doors on opposite sides of DC-3's? On page 38 of your December issue is a Pennsylvania-Central Airlines DC-3 with the door on the left side while, on page 44 of the September issue, there is a DC-3 with the door on the right side. . . .

ROBERT NOCE.
Memphis, Tenn.

● Douglas builds its airliners to contract specifications of each airline. Pennsylvania-Central, TWA and Eastern Air Lines ordered the doors on the left side of their DC-3's; United Air Lines and American Airlines ordered theirs on the right. —Ed.

Pre-Solo Club
Sirs:

. . . Like Reader Chandler [page 54, FLYING and POPULAR AVIATION, January, 1941], I feel I could write a book even on my meager eight hours of flying. I propose a Pre-Solo Club, to be sponsored by FLYING and POPULAR AVIATION; members being forced to give up membership on soloing. . . .

EDWARD T. ROBINSON.
Bridgeport, O.

Solved!
Sirs:

. . . In answer to Mr. Meyers' inquiry [page 52, FLYING and POPULAR AVIATION, February, 1941], "how the psychologists obtained their answer 93715?", is is quite simple. The missing factor is +4. Example: 9-7-5; 9+4= 13+4= 17+4= 21+4= 25; thus the answer 93715 is obtained. . . .

JANE H. WILSON.
Highland Park, Mich.

● Oh . . .—Ed.

Pleased
Sirs:

. . . I wish to thank you for your letter [regarding "Solo From the Start," FLYING and POPULAR AVIATION, January, 1941]. The reason for the delay in answering . . . is the fact that I passed it around to our various instructors and asked them for comments. Their comments were all of the highest and (they) considered the article very good and well written. Also, Air Commodore Fellowes from England was so pleased with the article that he is taking a copy back with him to England to show to officials of the Air Ministry. . . .

E. A. LINK, Jr.,
Link Aviation Devices, Inc.
Binghamton, N. Y.

Puzzled
Sirs:

. . . I would like to know something of the way the "Wings of Destiny" program is handled. . . . How is the winner [of the weekly award of a Piper *Cub*] selected? How can the editor of FLYING and POPULAR AVIATION and two other fellows, in a few hours, select a winner from all these 48 states? . . .

J. E. CLARDY, Jr.
Jackson, Tenn.

● Several readers have suggested that the "Wings of Destiny" contest is run dishonestly. Such an assumption is uncalled for, especially when such accusations are made by persons knowing nothing about how the program's weekly winner is selected. In one typical week recently, this contest received 45,000 entries. During the week, preliminary judges weed out the obviously poor entries, boiling the total down to six or 10 final entries. The latter are those given the judges in the radio studio on Friday night. These judges, picked at random, do not see the final entries until a few minutes before the program goes on the air. Obviously, then, any person entering this contest has one chance in, say, 45,000 of winning the airplane.—Ed.

Challenge
Sirs:

. . . In your January issue, in "Have You Seen?", you called a Dornier Do-17 Junkers Ju-88. Am I right or wrong? . . .

JAMES CAHILL.
Hanover, Mass.

● Wrong.—Ed.

Change
Sirs:

. . . I have noticed during the last few months that the POPULAR AVIATION on the cover . . . is getting smaller while the FLYING is becoming larger and larger. Can it be that old P.A. is soon to be deprived of its original name? . . .

PETER M. BOWERS.
Oakland, Cal.

● Eventually, this magazine's name will be FLYING, with POPULAR AVIATION retired after many years of faithful service.—Ed.

Perseverance
Sirs:

. . . I am a farm boy in the "sticks" of Indiana County, Pennsylvania. I am 17 . . . and a junior in high school. I had my first airplane ride during 1937; ever since then I have spent three-fourths of my time at air fields. Since I've been big enough to taxi a tricycle from the kitchen to the front room without ground looping, I've wanted to fly.

I made a deal with a local instructor in 1938 to trade a crop of potatoes for some time. At market price, it took seven bushels of potatoes for one hour of dual. I was 15 at the time, so my instructor suggested that I not fly, after I had had a few hours to just feel things out, until I was of solo age. After 3 hours and 45 minutes I quit until I was 16. Meantime, my potatoes rotted and the next crop was of peach-seed size. During 1939 I didn't fly at all; in 1940 I managed to solo a J3F-50 *Cub*. My weekly allowance was $3.50, which got me a half-hour every Sunday. After I soloed, it got me about 45 minutes a week. When school started, my allowance plunged to almost nothing. I managed to fly five and 10 minutes a

(*Continued on page* 88)

AIRCRAFT

CULVER

Cadet, LCA

Culver Aircraft Corporation — Wichita, Kansas

AIRCRAFT

LUSCOMBE

8A-8B1

Luscombe Airplane Corporation — West Trenton, New Jersey

AIRCRAFT

WACO

S.R.E.

Waco Aircraft Company — Troy, Ohio

AIRCRAFT

WACO

U P F-7

Waco Aircraft Company — Troy, Ohio

LUSCOMBE 8A-8B1

COSTS: List price: 8A, $2,195; 8B1, $1,885. Minimum down payment: 8A, $731.66; 8B1, $629. Annual insurance premium: 8A, $241.45; 8B1, $185.50. Operating cost per hour: 8A, $3.40; 8B1, $2.50.

PERFORMANCE: Miles per gallon of fuel: 25. Cruising speed at 75% horsepower: 104 m.p.h. Maximum speed at sea level: 145 m.p.h. Stalling speed: 37 m.p.h. Cruising range (excluding 10% fuel reserve): 315 miles. Service ceiling: 15,000 ft.

SPECIFICATIONS: A. T. C. 694. Type of airplane: CLM. Type of construction: Metal and fabric. Engines: 8A, 65 h.p. Continental A-65: 8B, 65 h.p. Lycoming 0-145. Fuel capacity: 14 gals. Weight empty: 650 lbs. Weight loaded: 1,200 lbs. Span: 35 ft. Height: 5 ft. 10 in. Length: 20 ft. Wing area: 140 sq. ft. Wing loading: 8.6 lbs. per sq. ft.

ACCOMMODATION: Number of seats: 2. Baggage: 55 lbs.

EQUIPMENT: Instruments (standard on this model): Airspeed indicator, tachometer, oil pressure and temperature gauge, altimeter.

WACO UPF-7

COSTS: List price: $8,765. Minimum down payment: unavailable. Annual insurance premium: 10%. Operating cost per hour: unavailable.

PERFORMANCE: Miles per gallon of fuel: 14. Cruising speed at 65% horsepower: 105 m.p.h. Maximum speed at sea level: 126 m.p.h. Stalling speed: 51 m.p.h. Cruising range (excluding 10% fuel reserve): 320 miles. Service ceiling: 14,300 ft.

SPECIFICATIONS: A.T.C. 586. Type of airplane: OLB. Type of construction: Wood and tube. Engine: 220 h.p. Continental W670. Fuel capacity: 50 gals. Weight empty: 1,889 lbs. Weight loaded: 2,650 lbs. Span: 30 ft. Height: 8 ft. 5 in. Length: 23 ft. 1 in. Wing area: 244 sq. ft. Wing loading: 10.86.

ACCOMMODATION: Number of seats: 2. Baggage: 25 lbs.

EQUIPMENT: Instruments (standard on this model): Compass, altimeter, tachometer, air speed indicator, oil pressure gauge, oil temperature gauge, clock.

CULVER CADET LCA

COSTS: List price: $2,395. Minimum down payment: $800. Annual insurance premium: 10%. Operating cost per hour: unavailable.

PERFORMANCE: Miles per gallon of fuel: 24. Cruising speed at 75% horsepower: 120 m.p.h. Maximum speed at sea level: 140 m.p.h. Stalling speed: 45 m.p.h. Cruising range (excluding 10% fuel reserve): 480 miles. Service ceiling: 17,500 ft.

SPECIFICATIONS: A.T.C. 730. Type of airplane: CLM. Type of construction: semimonocoque. Engine: 75 h.p. Continental A-75. Fuel capacity: 20 gals. Weight empty: 750 lbs. Weight loaded: 1,305 lbs. Span: 27 ft. Height: 5 ft. 6 in. Length: 17 ft. 8 in. Wing area: 120 sq. ft. Wing loading: 10.88 lbs. per sq. ft.

ACCOMMODATION: Number of seats: 2. Baggage: 50 lbs.

EQUIPMENT: Instruments (standard on this model): Oil pressure gauge, airspeed indicator, tachometer, oil thermometer, altimeter compass, fuel gauge.

SPECIAL FEATURES: Tab, fixed slots, retractable landing gear, adjustable pitch wood propeller (optional).

WACO S.R.E.

COSTS: List price: $17,800. Minimum down payment: $5,933.33. Annual insurance premium: $1,735.50. Operating cost per hour: not available.

PERFORMANCE: Miles per gallon of fuel: 9. Cruising speed at 65% horsepower: 195 m.p.h. Maximum speed at 5,000 feet: 202.4 m.p.h. Stalling speed: 60 m.p.h. Cruising range (excluding 15% fuel reserve): 880 miles. Service ceiling: 23,500 ft.

SPECIFICATIONS: A. T. C. No. 721. Type of airplane: CLB. Type of construction: metal, wood, fabric. Engine: 400 h.p. Pratt & Whitney Wasp Jr. Fuel capacity: 125 gals. Weight empty: 2,734 lbs. Weight loaded: 4,200 lbs. Span: 34 ft. 9 in. Height: 8 ft. 8 in. Length: 27 ft. 10 in. Wing area: 246 sq. ft. Wing loading: 17.06.

ACCOMMODATION: Number of seats: 5. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): altimeter, airspeed indicator, bank and turn, rate of climb, compass, electric fuel gauges, manifold pressure gauge, oil pressure gauge, oil temperature gauge, tachometer, carburetor and outside air temperature gauge with selector switch, single lead thermocouple, volt ammeter, electric starter, 15 ampere generator, navigation lights, landing lights, instruments indirectly lighted with rheostat control.

Interior fittings: hydraulic brakes, dual rudder pedals, throw-over control wheel, cabin heater and ventilators, adjustable front seats, ash trays, assist cords, rear seat arm rests, tool kit, first aid kit, fire extinguisher, tie down ropes, rear seat reading lights, map light for front seats.

Propeller: Hamilton Standard, controllable.

SPECIAL FEATURES: electrically operated flaps, Waco-type enclosed engine cowl with pilot-controlled ventilator.

THE CALCULATION OF RANGE

by RAOUL J. HOFFMAN

THE range of an airplane is the maximum distance it can fly with its fuel capacity. The distance an airplane can reach, drop its bomb load and be able to return to its point of departure is the bombing range. The bombing distance, naturally, is reduced as the bomb load increases.

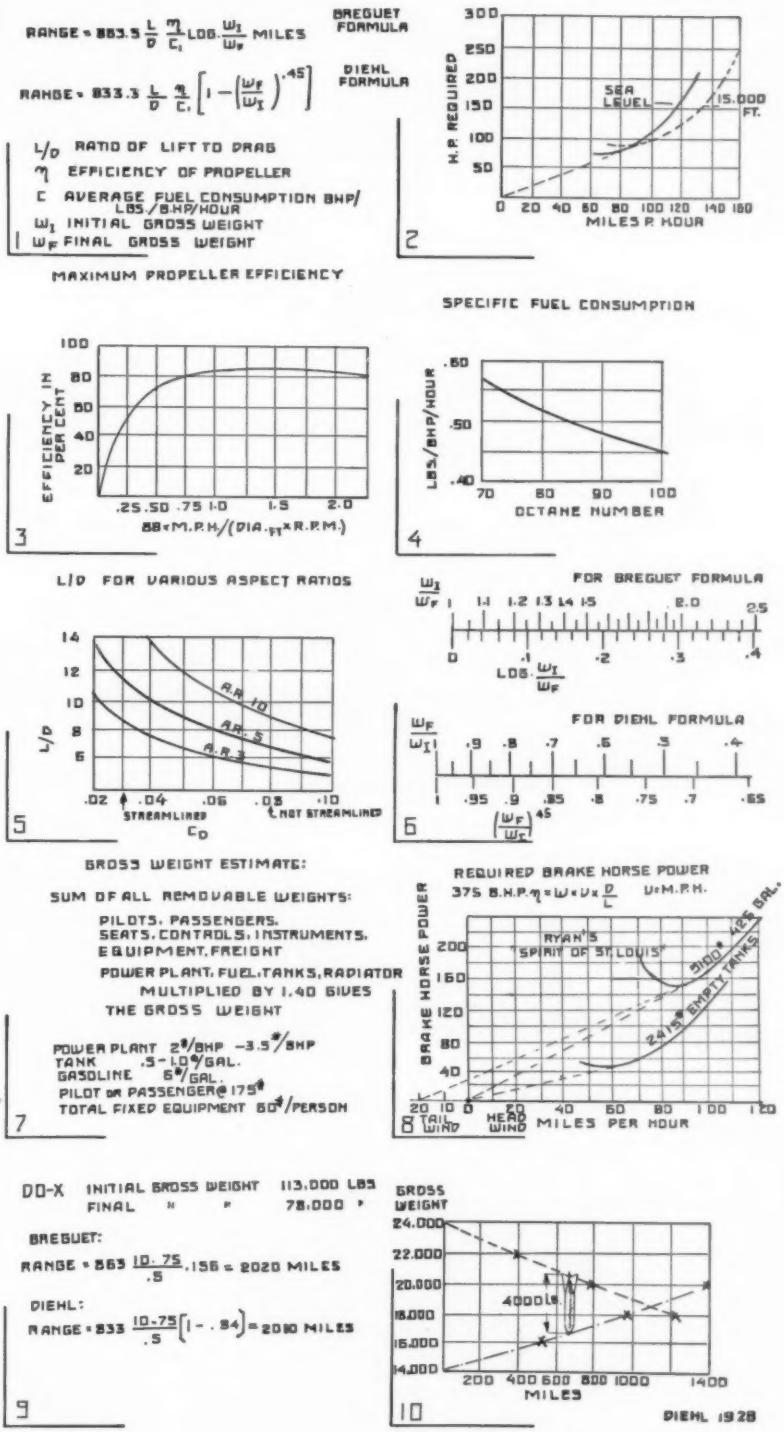
The distance obtainable at maximum speed is easily estimated simply by dividing the fuel capacity by the amount of fuel consumed per hour and multiplying by the maximum speed. More intricate is the estimation of the maximum possible range of an airplane. Many factors controlling the range are indicated in the two empirical equations given in Section 1 that may be used for approximating the range of an airplane. A step-by-step calculation would alone give exact results. In the diagram in Section 2, two curves are plotted denoting the required propeller h.p. at various speeds; one curve for sea level performances and the other for 15,000 feet altitude. A line drawn to points on the curve indicates the speed-power ratio or the distance traveled with a certain amount of fuel if the fuel consumption is assumed to be in direct proportion with the propeller h.p. Consequently a tangent drawn to the curve should give the best condition, the maximum distance obtainable with the least amount of fuel. Actually this is not the case for the fuel consumption is closely proportional to the brake horsepower of the engine. The required brake horsepower is found by dividing the propeller horsepower by the efficiency of the propeller. A diagram in Section 3 shows the maximum propeller efficiency at the advance per diameter.

Fuel consumption depends on the octane number of the gasoline, as shown in a diagram in Section 4. Other factors affecting the consumption are the amount of air in the mixture, the air pressure at the manifold and the humidity of the air. The greater the humidity the more heat is consumed by the water vapor and, consequently, the thermal efficiency of the engine will be reduced.

Aerodynamically, the power required is in proportion to the weight and the speed, and is indirectly proportional to the gliding angle and the efficiency of the propeller, as indicated by the equation in Section 8. The main factor is the ratio of the weight and the required thrust, expressed by the lift-drag ratio (L/D), commonly called the gliding angle. The higher the L/D, the less power is required.

The gliding angle is a function of the dead area and the aspect ratio of the wing. A diagram in Section 5 depicts the change of the maximum gliding angle with various dead (parasite) areas and aspect ratios. Narrow bodies and tapered wings give higher L/D values. Long range airplanes have slender fuselages, limited in size only by the outline of the engine and highly tapered wings, limited by increasing weights. The aspect ratios

(*Continued on page* 84)



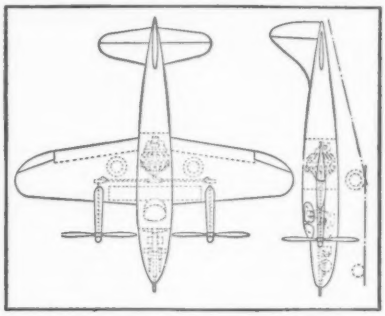
Diagrams above, referred to in the article, illustrate author's points.

First twin-engined advance trainer to be delivered to the Army is this Cessna AT-8 now in production.

Awaiting its A.T.C. is the revived American Eaglet, now built in Fort Worth, Tex.

A Brooklyn invention is hammerhead prop.

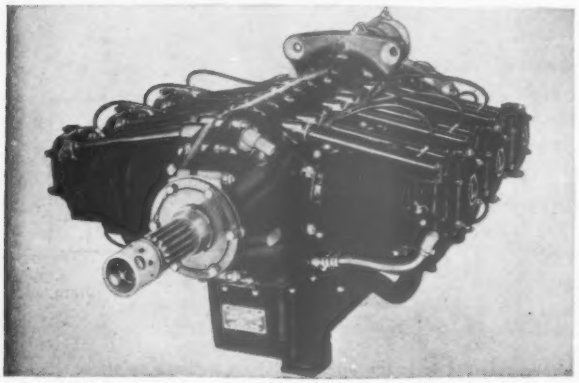
This unusual North American BT-9, with bent wing tips, was photographed at Detroit.

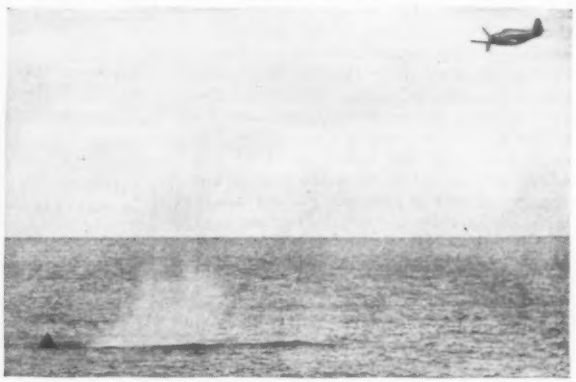


Above is new United Aircraft fighter plan.

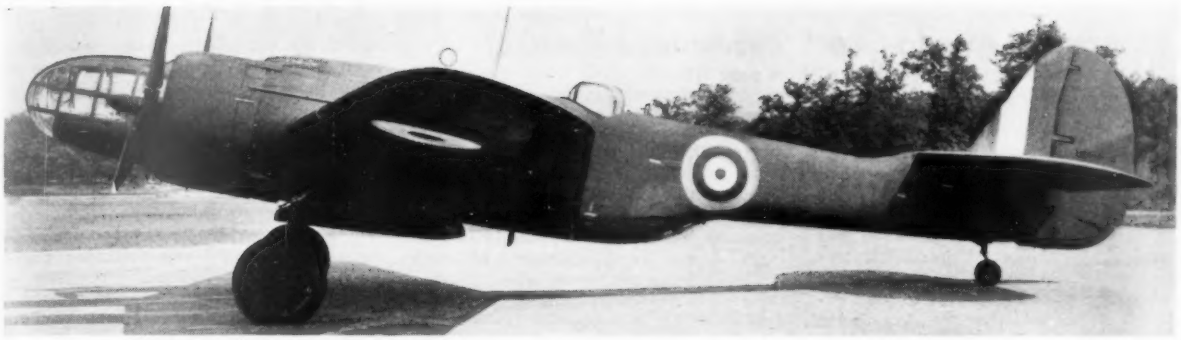
Now being tested is Fleetwings XBT-12 (450 h.p. "Wasp"). Note airflow tufts on wing.

New "lightplane" engine is six-cylinder 175 h.p. Lycoming.



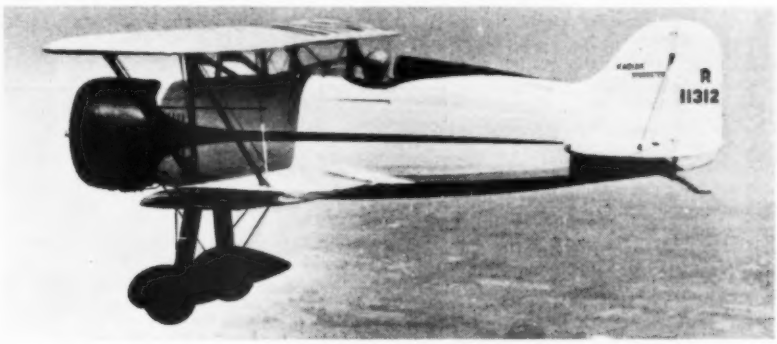


Bell "Airacobra" is firing burst at target in Lake Ontario.



Latest Martin "Maryland" above, going to R.A.F., has instructions lettered on fuselage in French.

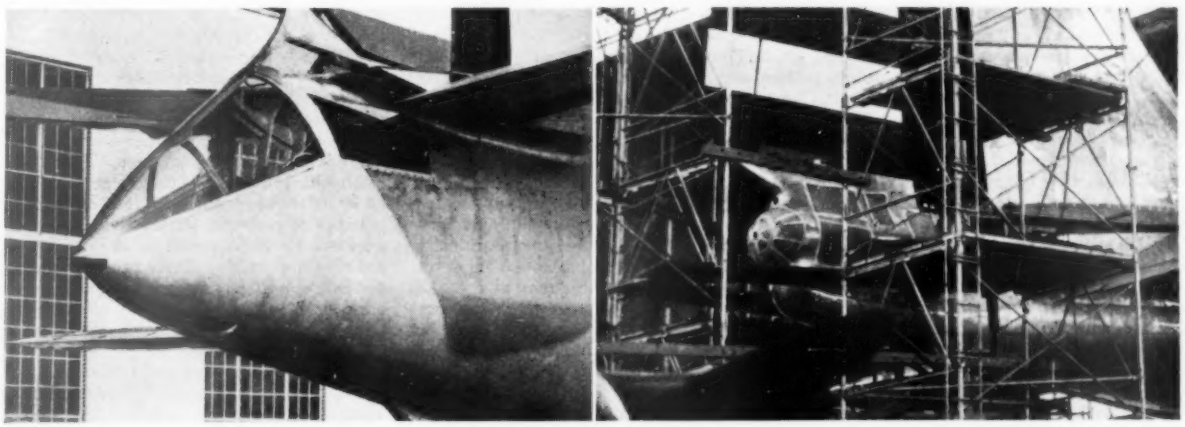
HAVE YOU SEEN ?



"Kadiak" biplane has 90 h.p. Lambert, cruises at 132, lands at 52, is unlicensed.

Experimental Combscraft has 75 h.p., retractable gear, cruising speed of 125 m.p.h.

First tail gun turrets on American warplanes are on the new Martin B-26 (left) and giant Douglas B-19.



Are Army Flying Cadet Standards Too Severe?

(*Continued from page 37*)

Improvements in planes can be easily advertised and obviously illustrated, but it takes an expert to tell a competent pilot from an undependable one. So the improvement in pilots, as a result of better training and better selection, has passed almost unnoticed despite its tremendous importance. The decrease in the number of accidents due to pilot error was more rapid than the decrease in accidents due to other causes. Credit for this must go, of course, to better pilot training and selection.

While discovering and adopting the most effective training methods, the Air Corps training experts also discovered that there were some students who, in spite of everything that could be done for them, simply failed to develop flying skill. Regardless of the amount of extra time and effort employed in the instruction of these men, they remained poor pilots. Extra time, extra help and costly experience produced some improvement in some cases but nothing could change the fact that these men were simply inferior as pilot material, obviously out of place in a military airplane, always awkward, often dangerous, and, from a military standpoint, worse than useless.

To allow these young men to make a profession of flying would be a criminal offence against those who would have to fly with them or around them and against the young men themselves. Of course, most of them *want* to fly and most of them are unaware of the seriousness of their own flying difficulties. The fact that they are unable to correct their most obvious errors is usually an indication that they are unaware of them. And, like all spirited and ambitious young men, most of them naturally believe they are just on the verge of blossoming into first-class pilots—just as the fourth-string quarterback is usually dying to get into the game and confident that he can surprise everyone with unexpected abilities. Such enthusiasm, optimism and determination is always commendable and often helpful, but it is no substitute for ability. No one, except perhaps an athletic coach, knows better than an experienced flying instructor the unpleasantness of having to dampen youthful enthusiasm for flying and the difficulty of trying to turn it into other lines. But, at the same time, no one is more aware of the dangerous futility of allowing young men who have considerable education and many talents to waste themselves on some activity at which they must always be inferior due to a fundamental lack of talent in that particular direction.

The article appearing in this issue, presenting the other side of this discussion, expresses very well some of the popular conceptions concerning our military flying training. Some of these conceptions are substantially correct, but others are based on the kind of misunderstandings and distortions which naturally result from an incomplete knowledge of the facts. A few specific examples will help to clarify these problems. Among other things, a surprising number of people believe:

1. That the Air Corps schools deliberately "wash out" a predetermined percentage of students.

Such a policy would, of course, be very foolish. Actually, percentages vary considerably from time to time and from

"They're having a little difficulty getting volunteers for the parachute corps . . ."

place to place, depending upon the comparative abilities of the groups of students involved. Some sections of the country, for instance, almost invariably provide a higher percentage of successful pilots than others.

2. That eliminations are arbitrary, sudden and final and that no man ever gets a second chance.

Actually, students are eliminated only on the basis of their entire record and all the flying characteristics they have displayed since beginning the course. And many are turned back and given a second chance after their original instructors have decided they are practically hopeless and have recommended them for elimination. Few of these men ever make the grade, but many are given another chance just because there appears to be some possibility that they *might*. If there is any reasonable doubt about a man's ability, he is given plenty of opportunity to prove it while he is still a cadet. This policy in itself explains the resultant policy of not readmitting cadets who have been eliminated. It makes more sense to keep men who show promise than to eliminate them and then re-admit them.

3. That only "physically perfect" applicants are accepted and that "only one in 10 pass the physical examination after applying for training."

Few applicants are found who are anywhere near "perfect." Even the rigid eyesight requirement does not even approximate perfection. Eyesight must merely be *normal*. A great many applicants have eyesight better than required. In all cases, only those applicants are rejected who have some infirmity or defect which would seriously handicap them as flyers —and the percentage accepted is nearer 50 than 10. One very active but thorough examining board in a large middle western city has recently examined over 600 applicants and has accepted more than half of them.

4. That many eliminations occur from reasons other than flying.

The requirements for appointment, while sensible and easily met, serve to weed out practically all undesirable characters, so that the number of eliminations for reasons other than flying is negligible. One school with which I am familiar has graduated and eliminated hundreds of cadets. All the eliminations were on flying, except a scant half-dozen for chronic airsickness or other physical difficulties which became prohibitively worse after appointment. None have been eliminated for any other cause.

5. That cadets who have had previous flying training have a very great advantage over those who have had no previous training.

This is decidedly untrue. As a matter of fact, only a small minority have had previous training and most of that minority have had only a few hours on very light planes. Despite the fact that the most air-minded and capable students should be found among those who have had previous training, such pre-trained students are often very disappointing. Often such training is of an obviously inferior quality, even when it was given under some program. But in any case it can not develop flying ability which is non-existent. Isolated small groups may be found in which flying success appears to coincide with previous experience. But despite the possibility of earlier solo and despite other obvious minor advantages, it is an actual fact that in checking through a class after only 15 or 20 hours of instruction, it is often impossible to pick out those who have had previous time. After 40 or 50 hours it is *entirely* impossible. More often than not the star pupil is a boy who had never climbed into a cockpit until he "Joined the Army."

6. That flying cadets suffer some kind of "rigid military regimentation" which tends to upset them mentally or emotionally.

PIPER POINTS THE WAY TO

. . . A MONEY-MAKING PLANE FOR OPERATORS
. . . A BIGGER PLANE FOR PRIVATE OWNERS
. . . AN ALL-PURPOSE PLANE FOR FLYING CLUBS

THE *Three-Place* PIPER CRUISER

with Mechanical Engine Starter

Introduced only last year, the three-place Piper Cruiser has speedily become the favorite of fliers desiring low first cost, economical operation and greater load capacity. It fulfills your every flight requirement. With dual controls in place the Cruiser is an ideal 2-S trainer. An engine starter, 450-mile cruising range, compensated compass and dual hydraulic brakes provide a safe, easy-to-fly cross-country airplane. Navigation lights and battery permit night flying. A stainless-steel exhaust muffler, side-by-side seating accommodations for two passengers and the economy of a dual-ignition 75-horsepower engine make it a real money-maker for pay-hopping. See your Piper Dealer for free flight demonstration. Priced at only $1995, F. A. F. Lock Haven, Pa.

FREE FLYING COURSE in his own plane is offered the purchaser of a new Piper. It consists of eight hours of dual flight instruction . . . take-offs, landings, taxiing and fundamental air maneuvers. At the completion of this free course the average person is ready to solo.

FREE FOLDER showing all the new Piper planes and details of the free flying course will be sent you on request or may be obtained from your Piper Dealer. If you wish a copy of the new Piper deluxe, full-color 16-page catalog it will be gladly mailed you providing you enclose 10c in stamps or coin to cover postage-handling. Piper Aircraft Corp., Dept. PA41, Lock Haven, Penna.

No Extra Cost for these Extra Features!

- ★ ENGINE STARTER *Standard Equipment*
- ★ TAIL WHEEL *Standard Equipment*
- ★ NAVIGATION LIGHTS *Standard Equipment*
- ★ CHOICE OF LYCOMING GEARED 75 OR CONTINENTAL 75-HORSEPOWER ENGINE
- ★ BATTERY & COMPASS *Standard Equipment*

Tune in "Wings of Destiny" NBC Every Friday 10 P.M. (E. S. T.)
Continental "65" Piper Cub Given Away Each Week

PIPER OUTSELLS ALL OTHER LIGHT PLANES COMBINED

Flying cadets are groups of men living together and working at a serious job. As such, they are necessarily subject to discipline, most of which they manage and enforce themselves as a part of their officer training. They study certain ground school subjects which are generally interesting, practical and of immediate application. They are well-housed, well-fed, get plenty of sleep, are usually free on week-ends and often in the evenings, if their grades are satisfactory. They get a few hours of military instruction and drill which, being lads of ability, they master with surprising rapidity. The rest of the time they spend on the flying line. Their life is busy, not easy, but the idea that it involves any real hardship for anyone who calls himself a man is mere nonsense.

7. That flying cadets are eliminated because of supposed "inherent inability to fly."

The phrase commonly used is "a lack of inherent flying ability" which means something far different. Actually not one cadet in 20 is unable to "fly" if "flying" means merely keeping an airplane in the air or even getting it up and down again without wrecking it. Only general ignorance and a lack of understanding of the great possibilities of flying can explain the strange tendency, so exasperating to those who have experience in training, to regard the mere ability "to fly" as anything significant. Almost anyone can soon learn to sit on a gentle and slow-walking horse without falling off. Almost anyone can soon learn to keep himself afloat in water. Almost anyone can soon learn to row a boat. Almost anyone can soon learn to get around safely in a simple, safe airplane. What of it? What have these obvious facts to do with the selection and training of expert horsemen, accomplished swimmers, able seamen, or competent military pilots? All of these require a certain amount of ability and talent. Military flying happens to require an unusual combination of abilities and talents. Is it not a surprising and remarkable fact that, due to careful, efficient and thorough methods of training, more than one-quarter of all those who apply and more than one-half of all those who begin training are qualified and accepted as competent military pilots just nine months after the beginning of their training? Can any other profession, any form of athletics, or even any difficult skill or trade show so high a percentage of applicants qualified, so little wasted time and effort, such efficient selection and so low a percentage of comparative incompetents among those whose training is complete?

8. That the Army's program forces each man into the same progress pattern.

Each man is taught certain maneuvers within approximate periods of time. This, of course, is necessary in order to insure that each man will finish the course with certain necessary abilities. But there is a wide variation in the rapidity with which even the better students learn these maneuvers. I have seen men who soloed shakily at 13 hours finish the course along with men who soloed at eight and who could have soloed earlier. I have ridden with students who, after 40 hours of training, were no more skilful than others after 20 hours, but who, nevertheless, completed the course successfully. Of course such cases are not the rule and it is a proven fact that hardly any men who require more than 12 hours to solo or more than 40 hours to learn secondary maneuvers *ever* become successful military pilots. Such latitude is often—perhaps too often—allowed in individual cases just in the forlorn hope that a man may miraculously "snap out of it" if he shows any excuse for such hope.

9. That only the "super-best" pilots are accepted.

There is a wide latitude of ability (a "painfully wide latitude" as any instructor will testify) between many of those who complete the course. Some students can perform many maneuvers just as neatly and efficiently as their instructors. Others (and there are more of these!) just manage to muddle through with the aid of optimism and prayer and the wishful belief on the part of instructors and check pilots alike that they are "just beginning to show improvement."

Perhaps our standards are a little higher than those of other countries now at war. It is quite logical that they should be. Certainly our fatality rate is much lower and our percentage of training ac-

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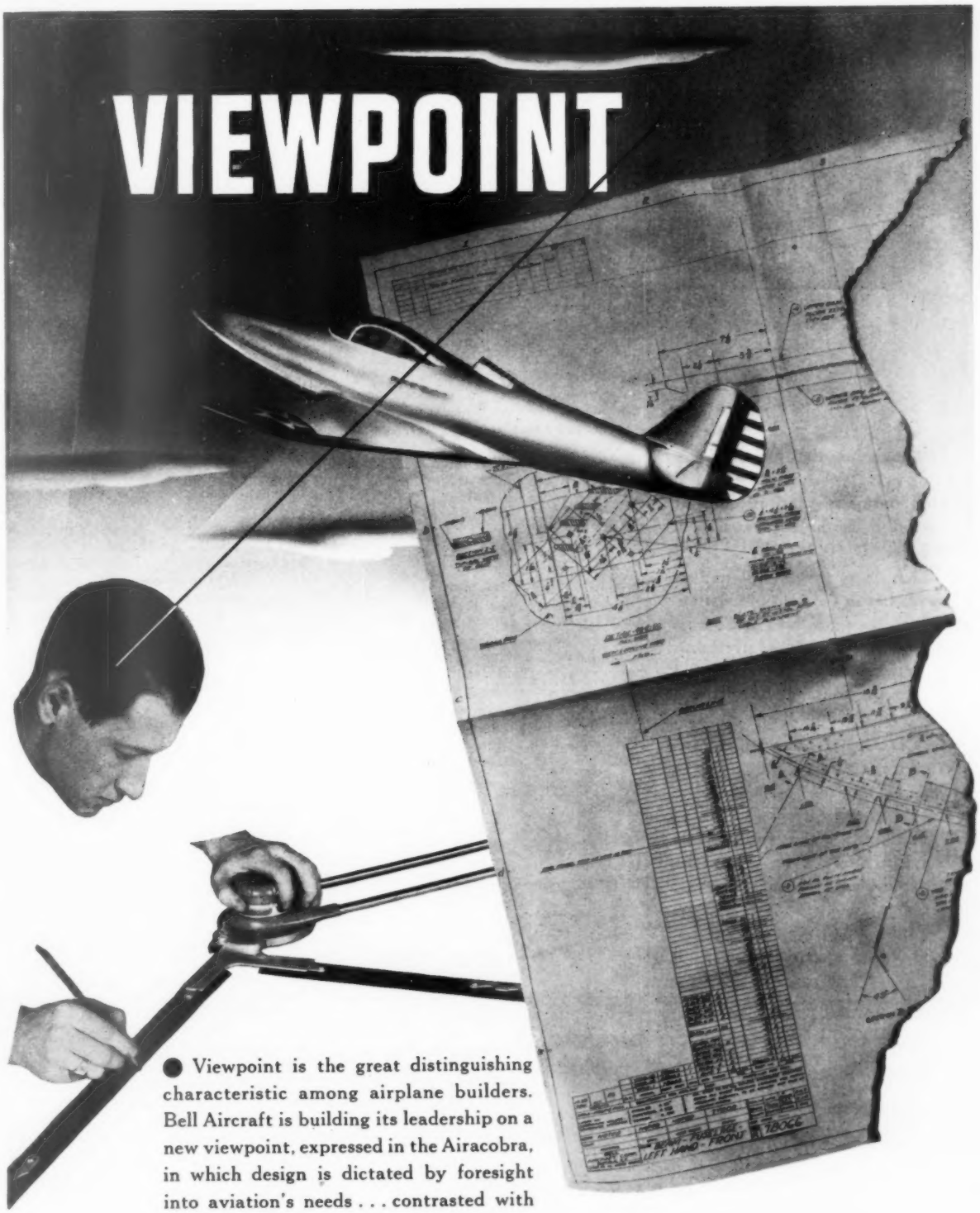

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cidents is remarkably low. It is also certain that we give more consideration to the welfare of the individual student than other countries. He is not arbitrarily shoved out of training without full and careful consideration of all his capabilities, nor is he arbitrarily kept there because he is hurriedly and desperately needed despite the fact that his own inaptitude stacks the cards against him before he ever leaves the ground. We are trying to prepare so that such wasteful measures will not be necessary. It would be stupid to adopt them now.

Even 50,000 pilots is a ridiculously small number out of millions of young men who should be available for training. We need to devote our energies to finding those who have ability, not to weeping over those who have not. Any uniform policy may occasionally work out to the disadvantage of some individuals and no policy is so perfect as to insure against the possibility of an occasional minor error or even injustice. But to fail to have a uniform policy of pilot selection and elimination would be fatal. Failure to apply such a policy without exception or favor would soon result in injustice to all. The policy we now have is not inflexible, because no inflexible system could have survived the tremendous load of expansion under which the Air Corps is now laboring successfully. It is not theoretical, because it works. It grew out of trial and error and costly experience.

We know the standards that are necessary for safety and dependable effectiveness. We know also that we must now train to match pilots who have already had months of actual combat experience! This would be a poor time to start second-choice or untalented material, or to start using our military facilities for jobs of secondary importance. It will be a long time before we get the *first* team trained. We know how to select and train first-class pilots. We have the system, the instructors and the equipment to do it. All we need is a wide choice of new flying talent. And we know that somewhere in this country there is plenty of such talent, well qualified and ready for development. For everybody's sake, let's have it!

END

Ultra-High Radio

(*Continued from page* 42)

Cabin, "just grew." The airway doesn't always follow the shortest line, there are many crooks and turns that are not present because of terrain or natural obstacles but are due to the political influence of a senator or congressman who had a say about appropriations for the airways and who wanted a favorite town to be "on the air route." And, above all, there are excellent technical reasons for changing over to ultra high frequency. Let us look at the present radio equipment and its characteristics and we can compare these with the equipment considered for the new program.

At this time there are more than 330 different radio range beacon transmitting stations—these are the stations that send out the radio beams which form aerial highways. Today there are more than 30,000 miles of this Federal airway network, the stations being roughly 100 miles apart. These stations send out signals on frequencies in the 200-400 kilocycle band which is just below the standard broadcast band of 500-1,500 kilocycles. Most of the stations are sending with relatively low power—from 100 to 400 watts; most of them are 150 watts.

Now, with only 100 different frequencies available between 200 and 400 kilocycles, it is obvious that there must be many duplications of frequency assignments to the radio beam stations. These duplications are multiplied because of the fact that a one-kilocycle separation in frequency is not possible at this time. Actually a three- to four-kilocycle separation is the maximum possible. This means that many stations share their frequencies with others. Attempts to minimize possible confusion to airplane pilots have been confined chiefly to making the geographical separation between such stations as wide as possible.

Furthermore, a large amount of natural electrical discharges send out radio waves in the 200-400 kilocycle band. Lightning, we all know, causes frying, crashing noises in the broadcast band and is equally bad in the 200-400 kilocycle band. Static electrical discharges picked up by airplanes flying in rain, dust or snow and subsequently leaking off the craft fill that band and interfere, in fact at times drown out, reception on this band entirely. These discharges have a peculiar crackling and frying sound of their own.

Then there is the skip-distance characteristic of 200-400 kilocycle signals. This, according to accepted theory, is due to the bouncing of these relatively long-waves between the ground and the Heaviside layer, or ionized envelope that is believed to encircle the earth. This envelope is invisible and is rather like a thick cloud-layer in its supposed form, having varying heights and depths in its surface—or perhaps its varying intensities in its electrical strength. At any rate the long-waves of the 200-400 kilocycle band shoot out from transmitting stations, strike this Heaviside layer (named for the scientist who deduced its presence) and rebound. Sometimes they rebound close to the station of origin—always there is some skywave close by—and sometimes they rebound at immense distances, thousands of miles away. For instance a radio range station in Utah and one in Pennsylvania have identical frequencies. It is possible that pilots tuned to the Pennsylvania station and flying close to it can find the Utah station's signals booming in, almost drowning out the closer signal.

All this leads to confusion—which is dangerous in an airplane. Furthermore the Heaviside layer itself is subject to strange disturbances at dawn and sunset; this causes wide variance in the beam signals at times. For a period of a half-hour or more at these times the

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200-400 kilocycle band signals fluctuate, vary, change their intensity and generally behave strangely.

This should be enough to give you an idea of why pilots and radio engineers have cudgeled their brains for years to find a better way of sending out the beam signals, changing the frequency or doing something to better these flying aids.

The solution as now presented is to move out of the range of these natural electrical phenomena into frequencies that are ultra-high where there is no interference. That is the solution as now decided upon. The new radio range stations will be in the band from 119 to 126 megacycles. These frequencies have been set aside for aeronautical navigational purposes by the Federal Communications Commission. The stations on the New York-Chicago ultra-high radio beam airway will send out their signals on four different frequencies within the relatively narrow limits of this band.

The development section of the CAA and various commercial airlines have been experimenting with ultra-high frequency radio beams for three years on the Pittsburgh-New York section of TWA's route, in Indianapolis and in Los Angeles. Reception has been unbelievably good, even in the midst of the worst thunderstorms and rain squalls, at periods when electrical storms on the sun were kicking up trouble for all other radio. Signals have come through to airplanes so clearly that pilots say they resemble the virtually perfect fidelity of frequency modulation radio. Pilots flying in the most difficult weather say that the ultra-high signals come through so well that they can hear the breathing of men on the ground to whom they talked, can hear the crackling of paper as airway attendants read weather reports into the microphone. All the little sounds hitherto lost entirely come through on the ultra-high frequency. At the same time, when the pilots switched back to their 200-400 kilocycle receivers, they were unable to hear anything except the roar, crunching and crackling of static.

Another factor about ultra-high frequency waves: they apparently penetrate the Heaviside layer and shoot on out into space, or they penetrate it deeply enough so their rebound is at an angle that does not permit them to return to the earth. The result is that skip-distance is eliminated entirely. The range of an ultra-high frequency station is pretty well limited to about 100 miles at the amounts of power now used for the longer-wave stations. This made an ideal approach possible.

Instead of using up to 120 different radio frequencies for the radio beam stations, engineers now propose to use about 20 different frequencies over the country. Inasmuch as range is limited and there is no return of these signals to the earth, it will be possible to place as many as 500 radio beam stations in the United States by using repeats of the 20 basic frequencies chosen.

A glance at plans for the new New York-Chicago ultra-high frequency airway shows how this will work in practice. Eight stations have been chosen but only four frequencies will be used. The first station will have frequency No. 1. The second will have No. 2 and the series will continue through stations No. 3 and No. 4. The fifth station, however, will revert to frequency No. 1 again, and the three remaining stations will also repeat with No. 2, 3 and 4 frequencies.

Instead of a radio receiver that has infinite tuning possibilities within the band the new ultra-high receivers will have 20 or 30 push-buttons for tuning fundamental range stations. Instead of grinding away on the "coffee mill," pilots will merely punch station No. 1 as they pass along an airway from the zone of No. 4 frequency into the beginning of the ever-repeating cycle.

At present, radio beam stations all have four "on course" legs. These are formed by the overlap from signals sent out by two antenna systems. Usually only two of the legs are used for an "on airway" station. For instance on an east-west airway only the east-west legs are used in most instances. The north-south legs of a station are wasted except as progress markers. On the new airways there will be only two-leg stations; where airways cross and where the north-south legs would be part of a crossing north-south east-west airway, there will be two separate stations. This will simplify orientation because, instead of quadrants, there will be only hemispheres where signals will be different. Each of the 500-odd stations that will be set up eventually with the ultra-high frequencies will have, of course, its own identifying signals as at present. A station at Chicago on, let us say, the No. 1 frequency still would have its identifying signal of CG. Joliet will have its JO on the No. 2 frequency, Indianapolis its ID on No. 3 frequency, Cleveland its CV on No. 4 frequency.

Now about the weather and homing grid. This would consist of stations having great power—up to 50,000 watts—and operating in the long-wave band. Each station would have a clear channel; there would be no duplication of frequencies here. Each station would blanket an area with a radius of 400 to 500 miles around it with its carrier wave. From these stations would come continuous airways weather reports in voice.

Geographic location of these grid stations is not definitely made, but they probably will be laid out in rows of six from coast to coast, with the width of the country from Canada to Mexico or the Gulf, covered four rows deep. Thus each station would be expected to cover an area of about 500 miles around it. This would allow plenty of over-lap between stations so that signals should blast through almost any kind of weather. The longer-wave frequencies would be used for these stations in order to get distance that is impossible with the short-wave stations.

These high-powered long-wave grid stations would not necessarily be on a Federal airway. Each would be a

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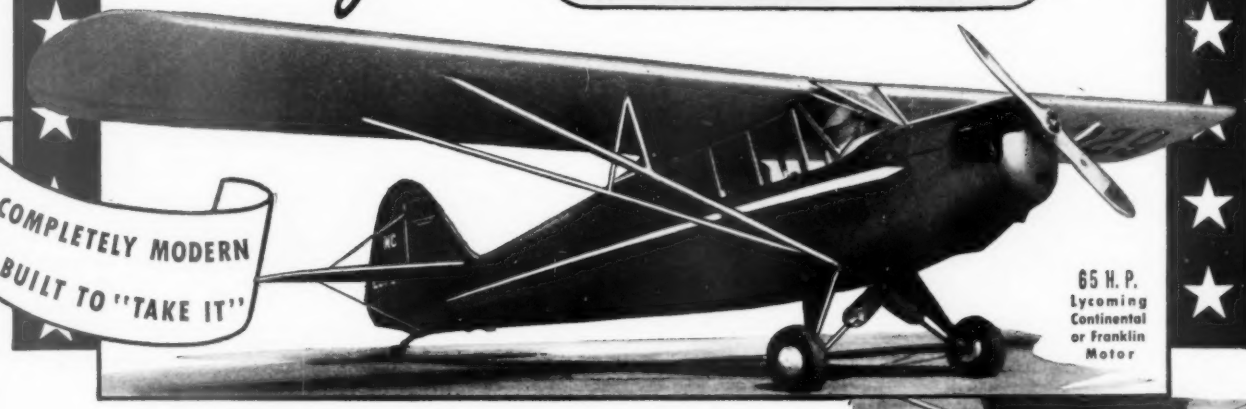

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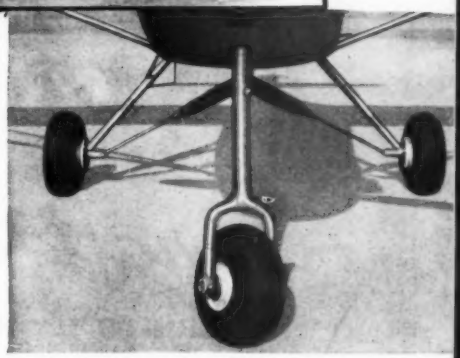

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weather reporting station and would be a local assembly point for weather information collected in its area. Meteorologists stationed at each of these points would make detailed analyses of their own area weather and would pass on to adjoining stations complete but less detailed reports. In turn they would receive fairly detailed reports from adjoining grid stations and sketchy reports from once-removed neighbors. All this information would be broadcast to airmen, and would improve the weather reporting service considerably.

For off-airway flights the grid stations would form ideal homing units. Laid out in a grid, it would be possible for pilots to take bearings on several stations simultaneously from almost any point in the United States. These bearings would place him fairly accurately (within a matter of three or four miles) at almost any time. It is not possible today to get such bearings at all points in the country.

The airways themselves would be laid out on the principle that now governs through highways. They would lead pilots as directly across country as possible. The east-west "mid-continent" air route that now extends from New York to San Francisco would not pass through Chicago directly, for example. It would pass south of Chicago. Planes going to Chicago would turn off northward on a Chicago "lead-in" beam, also in the ultra-high frequency band.

Use of ultra-high frequencies ties in directly with the true "instrument-landing" systems that are about to be installed at principal airports. In the same ultra-high frequency receiver used for the beam system radio, one of the push-buttons will be for the universal instrument-landing frequency. Once a pilot has reached his field "on instruments" he will punch the proper radio button to pick up the landing signals and will follow these right down to the ground until his wheels are rolling on the airport runway.

Don't think that the picture outlined herewith is Jules Verne-ish or that it is in the distant future. It's not. It will be here tomorrow. But do not think either that it will come suddenly. The New York-Chicago airway is the first step. Extensions will be made along the main air routes and both the old and new beam systems will be operated simultaneously for years yet to come—perhaps as many as 10 years, although the writer believes that it will be no more than five years before ultra-high frequency is the only one in general use. When it comes, flying will be safer, easier and therefore more likely to be of real utility to the nation at large.

END

Mountain Flyer

(Continued from page 47)

peared to be successful. But a division of opinion among sportsmen over the merits of the method resulted in heated controversy and forced abandonment of the practice.

A more spectacular job for the commission came last summer under emergency conditions. The state game officials had ordered 40,000 of the rare greyling fingerlings from the Federal Bureau of Fisheries at Bozeman, Mont., for planting in primitive area lakes. Then they learned that the bureau would be able to transport the fish in its special tank trucks only as far as Missoula, Mont., rather than to Hamilton, Mont., where facilities for packing them to the lakes were ready. As many do in emergency, David J. Maclay, director of fisheries for the Idaho commission, called on Zimmerly.

The fish were destined for seven lakes in The Crags, Idaho mountains in the region of the Selway and Lochsa rivers. All but one are bounded by towering peaks. To get to each, the pilot had to drop his ship down several thousand feet below the tops of the surrounding pinnacles.

"At times, as we were gliding down into them and banking to miss the crags, all I could see were mountains, trees and a lake that sat sideways to the world," is the way Maclay summed up his impressions of the trip.

With Maclay serving as "bomber," the fish were dropped in five-gallon tins. These had heavy bails, to which burlap Forest Service parachutes were tied. The top of the tins had been removed to permit the fish to escape when the tins submerged, which each did readily as a result of the 400 to 800-foot fall and the weight of about three gallons of water in them.

Maclay rates the emergency experiment as highly successful and says that, if the costs are not too high, the commission will endeavor to plant a few of the more inaccessible lakes each year by airplane. The planting this summer enabled the release of the 40,000 greyling in the seven scattered lakes in a bare two hours. The alternative method is a three-day trip with a truck and one on pack animals. This results in a high percentage of loss, while in the airplane plantings, most of the fish went into the lakes alive. The only factor that might cause the commission to have the fish still packed in for long distances is that this work is done by Fish & Game Commission or Forest Service employes in regular line of duty, while the cost of an airplane would be extra expense.

The plentiful game in Idaho's primitive area, which is the second largest in the nation, attracts sportsmen from over the world. Before the days of the airplane, penetration of the primitive area was no suitable adventure for the pink-skinned to attempt. To reach some of the best hunting districts, parties had to hike or ride pack horses for many painful miles through primeval wilderness. Today, the combination of Zimmerly planes and the dozens of good airports in the primitive area make hunting in those wilds almost as easy as angling in a fish hatchery pond.

One-day hunting trips are common. A sportsman leaves the Clarkston field and is whisked the 110 miles to the dude ranch of Alvin Renshaw at Moose creek in one hour and 10 minutes. Often Bert must zoom over the forest service airport before landing to chase deer or elk from the field. If the hunter is in a hurry, he can walk out from the airport and bag a deer within half an hour. He can also have an elk within another three hours and the chances are that to get it he won't walk over three miles. He loads his game into the airplane, takes off and flies back to Clarkston—he has spent about six hours on the trip and in that time has bagged

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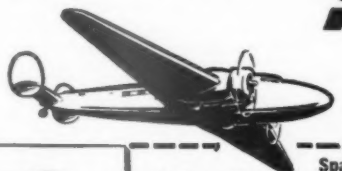

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the limit and has it ready for the cold storage lockers. One-day hunting trips are so practicable that Bert generally waits until the last day of the season to go after his own share of the season's kills.

Flying passengers into these Forest Service airports is no work for a novice. Most of the fields are small and surrounded by timbered hills. The pilot must bring his ship in slower than he would on most fields and he must be a master of precision landings. Passengers have little worry, however, in making the trip with Bert. In the six years that he has been flying out of Lewiston and Clarkston airports into these landing fields, no passenger of his has received even a minor hurt.

The Forest Service often calls on Bert Zimmerly during its annual hours of trial —the late summer months. Outstanding among the jobs he is called upon to do is the delivery of supplies by parachute to fire-fighting crews. Often this means eight and 10 hours of almost constant flying. Perhaps in one day, he will unload bales of hay from his ship at 100 feet to fall—this time without parachutes—near a pack string in an isolated area, send down pumping equipment to a crew of fire-fighters, toss out hot lunches at noon to a crew on the fire lines so the men will not have to return to camp, drop canned goods and meats beside a main camp so the cook can prepare the evening meal and throw out tins of ice water throughout the day to the crews on the fire line to relieve their thirst.

Condemned Army parachutes are used in dropping supplies, each carrying to earth a load of between 150 to 200 pounds. They must be tossed out at low altitudes, which accounts for Bert's use of the Travel Air. He has been using one for several years. Two years ago, he had an opportunity to buy a damaged ship of that type. He rebuilt it to enable him to keep up with his increasing Forest Service work. Although the ships are no longer being built, Bert likes them because they can be pulled out easily from tight spots at low altitudes. They have the power to pull away from tricky currents caused by the forest blazes and from the downdrafts which might spell disaster to underpowered ships. At the same time, the Travel Air will sit down on small fields and get off them safely.

Bert also does considerable dropping of supplies aside from his Forest Service work. Many miners work their claims in the primitive areas throughout the winter. When they run out of supplies they call him over a Forest Service telephone line. He is often asked to drop food to them, including eggs—which land in fairly good condition. They are always usable, though a few crack. Sometimes it is mining equipment that goes overboard to land in snow as deep as 12 feet, or it might be oil or grease for the equipment. Many times a year, Bert loads heavy mining equipment which must be landed on Mackay Bar in the Salmon River canyon, second deepest in the nation.

Bert rates as his toughest task the one to which the Forest Service called him early one spring when the temperature was 10° below zero. A cable for a suspension bridge and accessory items were to be flown to the Crandall ranch on the middle fork of the Salmon River. The cable could not be cut and it made a heavy load for the ship. The field on which he was to land was covered with ice and snow. It was so cold that the plane's engine had to be preheated. And the crowning difficulty—only enough gas to make a one-way trip could be carried without overloading the plane. He had to land when he got there, no matter what. It was crowding the margin of safety more closely than Bert generally does. He made it. But when he recalls the experience it's with a wry smile and a "whew!"

Bert was among the pilots who early made coyote hunting by air possible for sportsmen and residents of the Lewiston and Clarkston area had many a thrilling trip, until the practice was terminated by CAA regulations two years ago. A lightplane was used for the sport. Bert took his shotgun-carrying passengers over the rolling hills in the immediate vicinity of Lewiston, flying low over the ridges and into the valleys. When the quarry was sighted, he dropped down to within a few feet of the racing animal. The passenger blazed away. If he downed the trophy, the ship had to be landed in what was usually a sloping wheat field so that the gunner could take home the proof of his ability.

Another job was added last spring to the already extensive list of Zimmerly enterprises. The Oregon game department called upon him to aid in a count of game in the Umatilla, Whitman and Wallowa forests. Fred was on leave of absence from North West Airlines and the two brothers alternated at flying teams of counters over the area when days were sunny enough to make deer and elk easy to sight.

Zimmerly Brothers Air Transport was one of the flying schools given a contract under the first civilian pilot training program launched by the CAA. Bert took charge of the instruction of students of Lewiston State Normal School. Then the Government asked him to establish a hangar on a Federal emergency field at LaGrande, Ore., and to train a unit there for Eastern Oregon Normal School. This has necessitated heavy expansion in equipment, until the firm now has a fleet of 15 ships. These include the two Travel Airs, a Cessna used for charter trips over the northwest and 11 light trainers. Four

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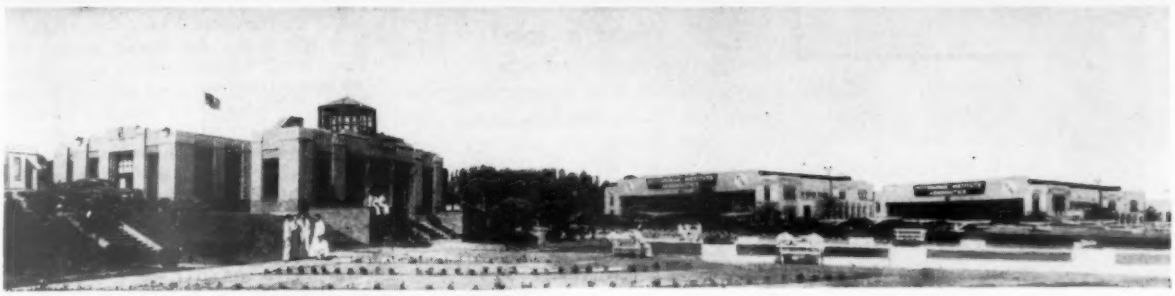

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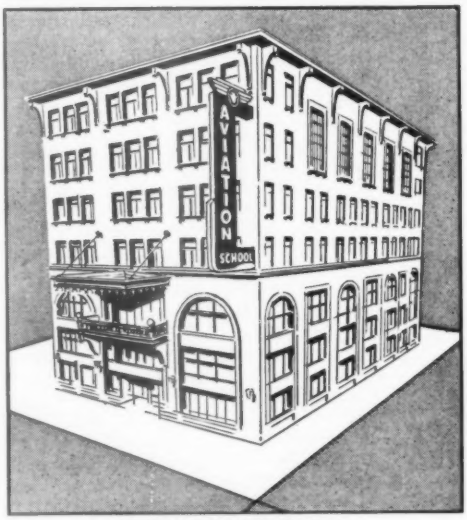

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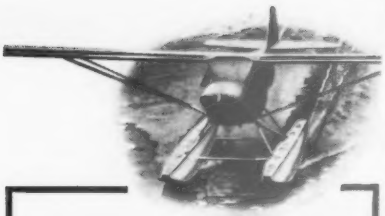

COAST TO COAST ON EDO FLOATS

Wolfgang Langewiesche

CAN a light seaplane be flown readily across the United States? Would such a trip be pleasurable and relaxing, with water landings available at frequent, convenient intervals along the entire route from coast to coast?

Wolfgang Langewiesche, author and sportsman pilot, sought and found the answers to these questions. With only 5 hours of seaplane experience, he flew his 65-h.p. Lycoming-powered Taylorcraft fitted with Edo floats, from Manhattan's Wall Street seaplane base to Lake Union in Seattle.

Throughout his route Mr. Langewiesche found an abundance of water areas suitable for landings and take-offs. To quote from his description of the flight—"lakes and rivers seemed to arrange themselves in a chain of emergency havens that was better than the best equipped civil airway . . . you can stop flying almost any moment you choose . . . I arrived at Seattle convinced that the seaplane is one answer to most of private flying's problems of safety, practical utility and fun."

With the crowded conditions and mounting restrictions encountered at so many airports today, a growing number of private flyers are becoming interested in the many unique advantages offered by water flying which has now been given so much impetus by the extensive system of seaplane bases constructed under the C.A.B. We will be happy to send a detailed description of Mr. Langewiesche's trip and up-to-the-minute facts about seaplane ownership and operation.

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EDO FLOATS
STANDARD THE WORLD OVER

flight instructors are now employed, besides Bert.

The direction of two flying schools keeps Bert busy shuttling back and forth from LaGrande to Clarkston, but he finds time to handle his other business. It is still Bert who does most of the flying in the heavier ships. It is still Bert that answers when the need arises for an airplane and pilot to perform a unique or difficult service for people isolated in Idaho mountains. And it is likely that he will continue to be in the vanguard of those who reveal and test out new uses for airplanes. END

Want a Job?

(*Continued from page 50*)

machinery motors, conduits within a factory itself. Ordinarily, they are master electricians who must be able to pass the requirements for master electricians of the city or county in which they are working. . . . Aircraft electricians work on the planes themselves.

Job Analysis

POSITION: Aircraft electrician.

WORK DONE: Installs wiring and electrical devices in aircraft, working from blueprints and wiring diagrams. Makes electrical sub-assemblies, working from blueprints and diagrams.

PROMOTIONAL FROM: Helper. (This is highly specialized work and while electricians and radio technicians from outside may be readily trained to this work, they are not ordinarily competent to work without supervision until they have had aircraft experience.)

WAGES: Seventy to ninety-five cents per hour, depending on the plant, the man's skill and the section of the country in which the plant is located.

EDUCATION: High school graduates with some technical training in electrical engineering are preferred.

EXPERIENCE: One year's practical experience in this work is essential. Learners may be drawn from allied electrical industries or from trade schools.

POSSIBILITIES FOR ADVANCEMENT: Supervisory work in this line.

* * *

Several persons have written in asking about the requirements for aircraft and engine mechanic's certificates. The requirements for either of these may be had in detail by writing the Civil Aeronautics Board, Washington, D. C.

* * *

Incidentally, a number of the men who have asked about the advisability of taking master mechanics' courses, seem to have sufficient experience as lathe, milling machine and shaper operators to get jobs as machinists. They should look into this, as a machinist's wages are among the highest in the industry. Airlines, of course, use machinists in their operations departments for maintenance. This advice applies particularly to G.H.N. of Hiwassee, Ark., and H.L.J., Jr., of Lyons, N. Y.

* * *

H.K.B. of Glendale, S. C., states that he has had eight years' experience in wood working and is proficient with any type of wood-working machinery. He has had correspondence courses in mathematics and blueprint reading. On the basis of this, it would appear that he is qualified for work in the wood shop or mill of a manufacturer. His location isn't going to help him, as South Carolina is not very close to the manufacturing centers. He might try a letter, however, emphasizing the fact that he is a thoroughly proficient wood worker and mentioning by name those particular pieces of woodworking power machinery which he can best operate.

* * *

K.E.P., Hamilton Field, Cal. When he gets out of the Air Corps, he shouldn't have much trouble getting an airline or manufacturing company job as a line mechanic. Probably his best bet would be an airline, but so far as we know there are no jobs in South America for airplane mechanics—although there may be. Mexico and many of the countries have restrictions on the employment of foreigners. Some of them even require foreign-owned companies, like Pan American, to hire native pilots. This is the case, at least, in Mexico—and, we believe, in Colombia. K.E.P. might make application to Pan American, with the ultimate object of getting transferred down there. Ordinarily, though, these foreign jobs just happen to a guy when he least expects them.

* * *

One job that may have been overlooked by a number of experienced men is that of C.A.B. aircraft inspector to one of the major factories. This is a Federal Civil Service job, but there should be openings from time to time. Applicants must have an aircraft or engine mechanic's certificate and some aircraft manufacturing experience. Specific information as to requirements may be had from the Civil Aeronautics Board, Washington, D. C. The Civil Air Regulations give these requirements and also give specific requirements for Federal Civil Service jobs in engineering, maintenance, regulation, operation of airways, radio electricians, traffic controllers, airway keepers, radio operators as well as what clerical help is needed. With regard to inspection, the district procurement boards of the U. S. Army Air Corps can give information as to qualifications of army aircraft inspectors for factory work, for which there are many new openings. In general, army inspectors will be required to be skilled in one or more lines of manufacturing mechanics and to have had several years experience in a factory.

* * *

We've had several inquiries as to how one becomes a meteorologist. Government meteorologists are employees of the U. S. Weather Bureau and are subject to Federal Civil Service. More specific information may be had by writing the personnel division, U. S. Weather Bureau, Washington, D. C. Many of the specialized aviation trade schools give advanced courses in meteorology, as do most of the major universities. . . . See you next month.

END

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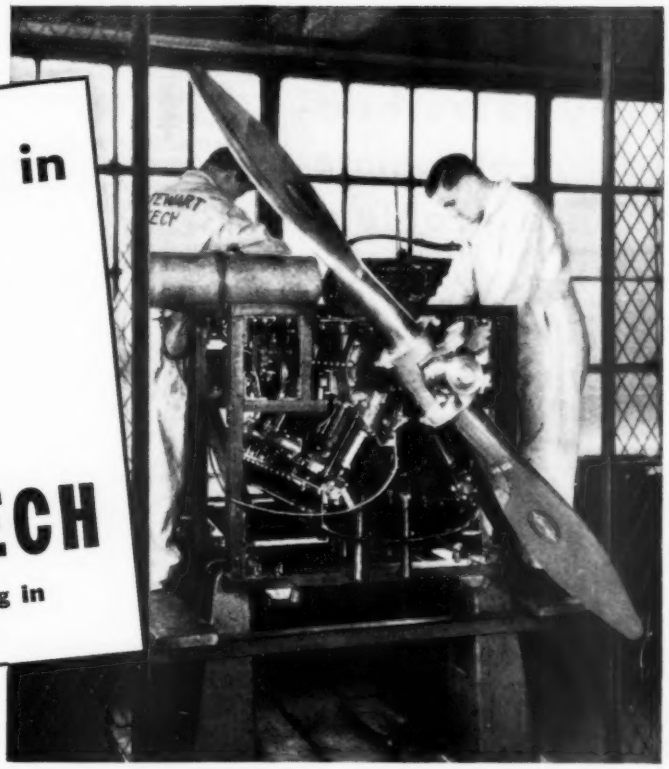

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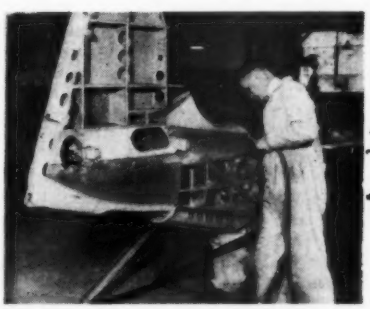

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Hornets' Nest

(Continued from page 35)

started the ball rolling.

Frank Markey, a senior, was their first prospect. He was making $10 a week as messenger boy for Postal Telegraph after school. More important, he had been flying occasionally for the past year, and planned on the Air Corps as soon as he had the two years' college required. He jumped at the chance of a club. Carl Cameron, whose father had been in the Air Corps and who wanted to join too, was making $10 a week ushering at the Imperial Theater after school. He felt that was not much money to start an aviation career upon, but the others convinced him he was practically rich. What was holding him back? Nothing. He joined.

In three weeks the boys had saved their $30 apiece although their other two members were still missing. They went window-shopping again at the airports. Two of the planes had been sold. The third was being test-hopped by a prospect.

In executive session the Hornets' Nest found the little bronze-colored plane would cost them $575. Financing and insuring it would cost them another $73. If each of six could pay $36 down, then $6 monthly would carry the rest. They would pay field manager Jimmy Woods $2 for each hour of flying time. At the end of the month, Jimmy would take the pay for gasoline, oil, and hangar out of the fund. The remainder would be turned over to the club treasurer. Jimmy would attend to motor and plane checks. Each member would pay Jimmy and Walt Malloney separately for dual instruction. It sounded perfect—if each could find $6 more and they could find two more boys. Quick.

They talked it over in some discouragement. Out on the field the bronze *Cub* came down to a landing, turned, taxied to the hangar. The prospect came into the office. The four boys crossed their fingers.

"Darn nice little crate, Jimmy," the man said. "But I want to think it over. I'll let you know."

"Want to take an option?" Woods asked.

"No, but I'll let you know soon."

He walked out. Stuart heaved a sigh of relief. At least he had given them an idea. "Look, Mr. Woods," he said. "We have $120 between us. Can we pay that down and make up the rest of the down payment within 30 days?"

Woods thought a minute. One hundred and twenty dollars and four student pilots did not sound like much protection for his plane. "If you want to pay it down, I'll hold the plane for you," he said at last. "But I can't give you possession until you complete the payment."

That suited the boys. But even $30 is quite a bit of money for a high school boy. Raymond Kimble, who had just graduated, asked if an alumnus were eligible. He was. Wilbur Byrd, who worked for Bell Telephone with Kimble, was a tottering old graybeard of 20, but he had a cousin in the Air Corps and his next-door neighbor was field manager for Eastern Air Lines. They invited him into the Hornets' Nest.

Fifteen days of the month had passed. They paid the money available to Woods. Within the next two weeks, they promised the other $6 apiece. Woods turned the plane over to them. It was promptly christened the Bronze Hornet and the boys began flying.

Operators are generally not too happy when high school boys fly. All too often, the boys are young enough to think they can be Flash Gordon or Smilin' Jack on two hours' instruction or none at all. Didn't they read a book once? The Hornets' Nest should have been a headache. There were four high school kids, one youngster just out of school. Supposedly Byrd, who was 20, might prove a balance wheel. But they soon proved no one need worry about foolish flying.

Two other boys from Central High asked to join. One was snicked out by his parents. The other reported at the field with $36 clutched firmly in one hand and a desire to be a hero firmly in his mind. He paid Carl Cameron and went up for his first lesson.

His solo almost made a field record for something or other. He took off in a zoom. He cut a vertical over the hangar. He did a wing-over to come into his approach. He came down to the runway, motor howling. A "pursuit landing" has its place even with a *Cub*. In the dark or in rainy weather or on water if you have floats, it is helpful to drag lower and lower, motor pulling smoothly, till you touch. Then throttle closed, you can coast to a landing. In any but emergency conditions, though, it is a plain bid for attention. And you must know the technique. That youngster did not.

He came in like a bat out of hell. Wheels touched and, like a kangaroo on the loose, the plane bounded across the field in drunken leaps. Just short of the fence he puller the throttle shut at the top of a 15-foot bounce. The plane shivered. Then stalled. In a big, fast ship the student would have repented behind bandages but, instead of nosing over, the average lightplane simply squats in a situation like that. The *Cub* did. Like a setting hen dropped off a nest, the Bronze Hornet plopped down at the end of the runway. Its landing gear flattened out till the belly touched the gravel for a moment. It rolled a yard, came to a dead stop.

The kid sat there a moment, then he slowly turned the plane and taxied back to the hangar. He got out with a certain amount of bravado. Every good pilot makes a bad landing occasionally. Sure.

But the Hornets were not listening. No one even spoke to him. Grimly they checked landing gear, wing-fittings, struts. Everything seemed to be all right. All right that time, anyhow.

They handed him his $36 plus $1.50 for his unflown hour and 45 minutes. They didn't have to call a meeting. The Hornets' Nest always has a quorum in flying weather on Saturday afternoon.

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In fact, any Hornet passes not only his instructor's okay, but he must pass the approval of the whole club. The day I visited them at Cannon Field five of them were sitting on the fence. One was flying. He dropped the plane in perhaps two feet. That is not bad flying. It is not the best. But it is *not* bad. Not unless you are a Hornet.

They piled off the fence. "Back in a minute," one said. "He's having trouble. We're going out and talk to him about it. Maybe he needs more check time."

Financially and for flying time equally, the club proved a good idea. Stuart Shannonhouse found he could fly about three hours a month on his $28 income, after he had paid his $6 a month on the plane and bought his school supplies. Bobby Ward, the other founder, with $32, could fly about seven hours, put money in the bank so he could hold his own in the club after he started to college and pay for school supplies. The other two high school boys could get in 10 to 12 hours. Kimble and Byrd, with full-time jobs, took advantage of the $2-an-hour bonanza almost every night after five o'clock. As for the rates, $2 proved ample. Bills were paid in full and on time. Enough remained in the fund to buy a compass and maps for cross-country.

It would be nice to say that no troubles have hit the Hornets. But cross-country finally spelled a minor disaster. Members were preparing for their private licenses and Bobby Ward, who had passed his 18th birthday and his private license test at the same time, took the Bronze Hornet off on the most ambitious trip the Hornets had tried.

The 40 h.p. *Cub* had only one big trouble. With nine gallons of gas, cross-country was largely dependent on favorable winds. On the way home, Bobby ran into a headwind that strengthened so that he ran out of gas some miles short of an airport. The Hornets were well-trained. He glided, dead-stick, into a pocket-handkerchief field. He might have made it, but he struck a ditch.

The Bronze Hornet was very nearly a washout. He trudged to the nearest farmhouse and phoned the field. Back in Charlotte, he joined the other Hornets in solemn session. Insurance would cover the last of the payments. The sale of the wreckage would make a good down payment on another plane. But Bobby would be going to college in the fall. Ed Brockenbrough at Municipal Field would buy the plane and pay them in flying time on his school ships. Perhaps, with their training well along now and the high cost of dual out of the way, that would be a better idea.

So that was the final decision. The Hornets are now flying with "Brock." Two of them are getting their hours up to the point where they are planning on commercials not too far in the future. All are ready for privates or near that point. Ward, now in college, and Cameron and Markey are marking time till they are old enough for the Air Corps. Shannonhouse will soon enter aeronautical engineering at North Carolina State. Byrd and Kimble will be ready for airline jobs before long. Every spare dollar is going on flying time in addition to the ransom of the Bronze Hornets' bones.

It looks as if Stuart Shannonhouse, whose grandpappy started the tradition "away back yonder," has started something of his own. The Hornets' Nest is still buzzing and six new pilots are preening their wings. Mecklenburg County still has its stings.

END

Gyro Guide

(*Continued from page* 41)

manner that his radio bearings will be read in degrees as relative, magnetic or true bearings. When the scale is set at 0°, the radio bearings are relative to the airplane's heading; when the scale is set at the same degree mark as the magnetic compass, the radio bearings are magnetic; and when, in addition, the scale setting is corrected for the east-west variation, the radio bearings are the true bearings of the transmitting stations. The indicating pointer is usually double-ended and the scale is divided into *equal* degree marks, so that the pilot can read both the actual bearings and their reciprocals. Note that, despite the versatility of the automatic direction-finder, all that the pilot can read at any moment is the bearing of the radio station *at that precise moment* and only with respect to his heading or course at that moment, and not with respect to his desired track —unless, of course, there is no wind, which hardly ever happens.

The Gyromatic Navigator consists of this type of a 360° radio bearing indicator, *plus* a directional gyro which actuates an additional pointer showing the desired track. Simple, isn't it? Well, the principle is simple and logical, but to make it work in an actual instrument is a difficult engineering job. A gyroscope cannot perform any mechanical work: it cannot drive a shaft to an indicator pointer. For this reason, it was necessary to place the gyroscopic unit immediately beneath the 360° scale and have the gyro indicator statically and dynamically balanced and coupled direct to the gyro unit. This, of course, means that the Gyromatic Navigator can only be available with a horizontal scale, not for vertical mounting on the instrument panel.

This is how the Gyromatic Navigator is built: in the bottom of the instrument case is the directional gyro unit; the gyro course-setting and caging controls are mounted direct on the instrument case. On top of this case is the 360° azimuth scale divided into equal degree marks; the scale is rotatable by hand and may be set for any desired course. The directional gyro unit inside the case is coupled direct to a lightweight transparent disc which is free to rotate with the gyro unit. On this disc is engraved a double reference line which, read against the 360° scale, shows the gyro bearing as set for a desired track. The double-ended indicating pointer for radio bearings is mounted concentrically with the gyro disc and is operated by the station-seeking loop of the direction finder unit, through a drive shaft.

Both the gyro disc and the radio bearing pointer are protected by a fixed glass cover on which is etched a miniature reference airplane. The Gyromatic Navigator is installed in the cockpit with the reference airplane coinciding with the longitudinal axis of the actual airplane in which the instrument is installed. On the forward edge of the glass cover is etched a fixed lubber line (for course setting) and on the metal glass cover rim is painted an east-west variation scale (for correcting the course setting for magnetic variation). Instead of the shaft drive for the radio bearing indicator pointer, we can also supply the instrument with AC Autosyn or DC Selsyn electrical drive.

The whole instrument measures about 5½ inches in diameter, including setting controls and fittings; and about 5½ inches deep.

To demonstrate "gyromatic navigation," let's start with a simple example (Figure 1). Here are two airplanes, one flying towards, the other away from a radio transmitting station. The pilot of the airplane flying towards the station is flying a course of 62°, "homing" on his radio bearing. He has set his gyro component at the same bearing, 62°, and now is flying a straight-line course toward the radio station. There is no wind; should wind spring up and drift him off his course, his radio bearing will drift away from the gyro bearing, warning

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him of his drift and its direction.

The pilot of the airplane flying away from the radio station is flying a course of 280°; he has set his gyro component at that bearing, coinciding with the *reciprocal* radio bearing of 100°. He, too, is flying a straight-line course and would be similarly warned, should wind spring up and drift him off his track. Thus, with the Gyromatic Navigator, any transmitting station becomes a "radio range," with an infinite number of courses which may be accurately flown towards or away from the station.

Figure 2 illustrates the problem of flying a desired track between two obstructions. The pilot, before he reaches the desired track, sets his directional gyro component at the desired track value (in this instance, 248°). His radio bearing, at A, is 285°. He sees at a glance, without any calculations, that he should proceed in a northwest direction in order to reach his desired track. When the track is reached, both his directional gyro and his radio bearings will coincide, enabling him to "home" towards the station along the desired track, correcting for drift should it become necessary. The same procedure would be used in flying a chosen track away from a radio transmitting station.

Drift detection and correction is shown in Figure 3. At A the pilot is "homing" towards the radio station, with both his radio and his directional gyro bearings coinciding. The wind drifts him to the left of his chosen track (B) and the Gyromatic Navigator warns him of that fact, through the growing divergence between the radio and the gyro bearings. Thereupon the pilot returns to his chosen track (C) and continues along that track at the correct drift angle, by steering a course just off the initial gyro bearings, in the same direction as the drifting radio bearing. If the wind is constant, the radio and the gyro bearings will continue to coincide at the drift angle and no further divergence will occur.

Navigation to a destination not equipped with a radio transmitting station is shown in Figure 4. The pilot gets his position fix by taking cross bearings on the radio stations A and B, plots it on his map and then plots his course to his destination. With an automatic direction-finder the entire operation takes little more than a minute. He then sets his gyro component for the chosen course and proceeds on that heading, checking his progress by the radio bearing on one of the two stations. When the radio bearing reaches the correct value (280° on Station A, in the example), he verifies his position by a cross bearing on the second radio station. Navigational procedure is thus reduced to a minimum and all calculations are eliminated.

Instrument approach and landing procedure is vastly simplified with the Gyromatic Navigator. The only ground station aid needed is a single non-directional radio marker (which may be mobile), located upwind on the prolongation of the desired runway. Figure 5 illustrates the approach and landing procedure. The pilot is advised by radio of his landing direction, and sets his gyro component for that value. Thereupon he flies to the radio marker, checks his altitude and proceeds on the reciprocal course as far as may be needed to lose enough altitude to permit final approach at a constant rate of descent. He then makes a 180° procedure turn, rechecks his gyro setting and "homes" for the marker along the landing track as shown by the gyro indication. When he repasses over the marker, the radio bearing pointer swings around. The pilot then rechecks his altitude and proceeds with the landing, continuing on the same course. The same landing procedure can be used with equal ease for marine landings, at permanent or temporary bases, with the marker located on shore or in a boat.

The versatility of gyromatic navigation also finds many uses in military aeronautics. A simple example is shown in Figure 6, where a flight of bombers is secretly guided to an enemy objective. A single mobile marker transmitter set up at a prearranged location supplies the necessary point of reference to give the bombers their course to the objective. The position over the objective can be established either by elapsed time or, if greater accuracy is needed, by a cross bearing on a second mobile marker.

These few examples should suffice to indicate the versatility and the wide range of application of the Gyromatic Navigator.

END

Phenomenal Flivver

(*Continued from page 27*)

plane that he does in a spin-susceptible, stall-inherent conventional ship. The results so far, at three flying schools, indicated that the man on the street can learn to fly the Ercoupe in half the time. Men and women from 18 or 19 up to 40 have been soloed in a few hours, one after only 2½ hours, the oldest after only 3 hours and 56 minutes. Half or a third the time required on conventional aircraft! The oldest man in one group reached the private certificate degree of proficiency in 20 hours and 5 minutes; on conventional ships, the CAA requires a minimum of 35. Another got there in 16 hours—less than half the time.

The airplane which is making possible this short cut to private flying is not unique in that it represents any startling innovation in design. Nor is its creator any long-haired scientist. He's an ordinary sort of fellow to look at and hear talk. Long, with a prominent nose and not much hair, he's slightly stooped and diffident in manner. Almost always he can be found in the background at aeronautical meetings. If you can get him warmed up on spin-proof ships for the little fellows he becomes voluble. Other times, he's mum as a olam.

Weick was born 41 years ago in Chicago. His father was a portrait artist—a good one. Fred showed no artistic tendencies, however, winding up with a

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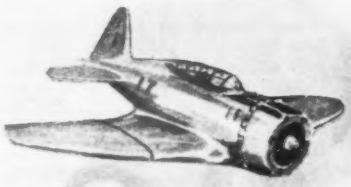

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degree in mechanical engineering from the University of Illinois. Although his family were in comfortable circumstances, he worked his way through. Sometimes he worked as a hired hand on middle-western farms, hitting places like Nebraska at harvest time. One summer he worked in a machine shop, an understanding boss giving him a chance to use all the machines. Another year he made drawings for an inventor of "various gadgets." Sometimes he made signs for merchants or sold gasoline, tires, spark plugs and other merchandise to farmers. He even built chicken coops.

He had developed an interest in aviation when he was a kid, spending his time hanging around the old Cicero flying field watching Lincoln Beachey and other pioneers take their rickety crates aloft. So when he graduated from Illinois, he got a job with the old Government mail service and helped convert surplus World War DeHavillands into mail planes.

After other aeronautical experience, he joined the Navy Department as a propeller designer in 1924. His work there attracted the attention of the National Advisory Committee on Aeronautics, which put him in charge of its propeller research wind tunnel, then largest in the world. He remained with NACA for four years, then spent a while with Hamilton propellers, acting as director of research while Frank Caldwell (one of the greatest propeller men in the world) was production chief.

Until this time Weick had exhibited no particular interest in anything except propellers, but he decided that he didn't want to confine his activities so closely and, in casting about for a broader field, became interested in airplanes for private flying. Coincidentally, NACA was having trouble with spinning and Weick was given an opportunity to return to its laboratories. Five years before, the Government had taken official notice of spinning as a dangerous characteristic and, when Weick returned to the NACA fold, the committee had several groups working on the problem.

They weren't getting anywhere and Dr. George L. Lewis asked Fred to try his hand. He agreed to let Weick have access, without exception, to all the facilities of the NACA. Accordingly, the engineer had the opportunity to investigate everything that might be used advantageously in private flying, including improved control methods as well as the elimination of spins.

"I was interested then," he says, "in getting all these known improvements of design into one airplane. Most of them were no good if applied individually to a conventional ship. For instance, two controls were valueless unless you could make cross-wind landings and for that you needed a tricycle landing gear."

Weick soon wanted to try his laboratory discoveries on a full-scale design. Starting with models in 1931, he and nine associates scraped up about $2,000 and went to work in his garage on a small experimental ship, the W-1. About the same time Eugene Vidal, then director of the Bureau of Air Commerce, appeared with his idea of the $700 airplane. It was slightly—about 15 years, more or less—premature, but he had John Geisse and a group working on the project.

Realizing that spins would have to be licked, Geisse went to Langley Field to find out what the NACA could do to help provide the public with an airplane. He was referred to Weick. The pair did a lot of talking about tricycle landing gears, two-control operation, non-spinning characteristics and so forth. Geisse finally remarked that all this suff was fine in theory, but that he thought the ideas should be given a practical test. Weick, who still doesn't offer information for which he hasn't been asked, hadn't bothered to mention that he was doing just that.

"He's got it all built in his garage," one of his associates finally blurted. Geisse demanded to see the W-1 and was so impressed that he wanted it tested immediately. He rushed back to Washington and got the Department of Commerce to write NACA and ask for a complete report on the still privately-owned airplane. The department bought the ship for $5,000 and the NACA put it through exhaustive tests in the spring of 1934. They found that it did just about everything Weick had expected. The Department of Commerce then set up specifications based on it, from which the Stearman-Hammond and the Waterman eventually were developed. In the meantime, the W-1 had been damaged in a forced landing—no one hurt—and rebuilt.

Weick kept on puttering, adding an improvement here and another there. He was in no hurry and, anyway, the time didn't seem ripe. It happened, however, that Henry Berliner had been a close friend of his for years and was interested in private flying. He had dropped out of the airplane manufacturing business and was making machine tools. About the time Fred decided he was ready to put his ideas into a commercial ship, Berliner decided he wanted to resume aircraft manufacturing. Weick left the NACA and became chief engineer of Engineering and Research. Their prototype was first flown in October, 1937, and still is flying.

Weick insists that there is nothing extraordinary about the ship. He said that, with the exception of a few minor patents, every feature of its design is in the public domain. It merely represents the most complete incorporation of known ideas into one ship. The problem, he contends, was to incorporate these desirable characteristics into a ship—which would still look conventional and be salable. It couldn't look like a flying bathtub.

It doesn't. It is one of the trimmest-looking airplanes on the market. The visibility is remarkable, even for a low-wing monoplane. Usually easy to handle, it is comfortable and fast for its size and power. Best, it is comparatively low-priced ($2,650) and probably eventually will cost even less.

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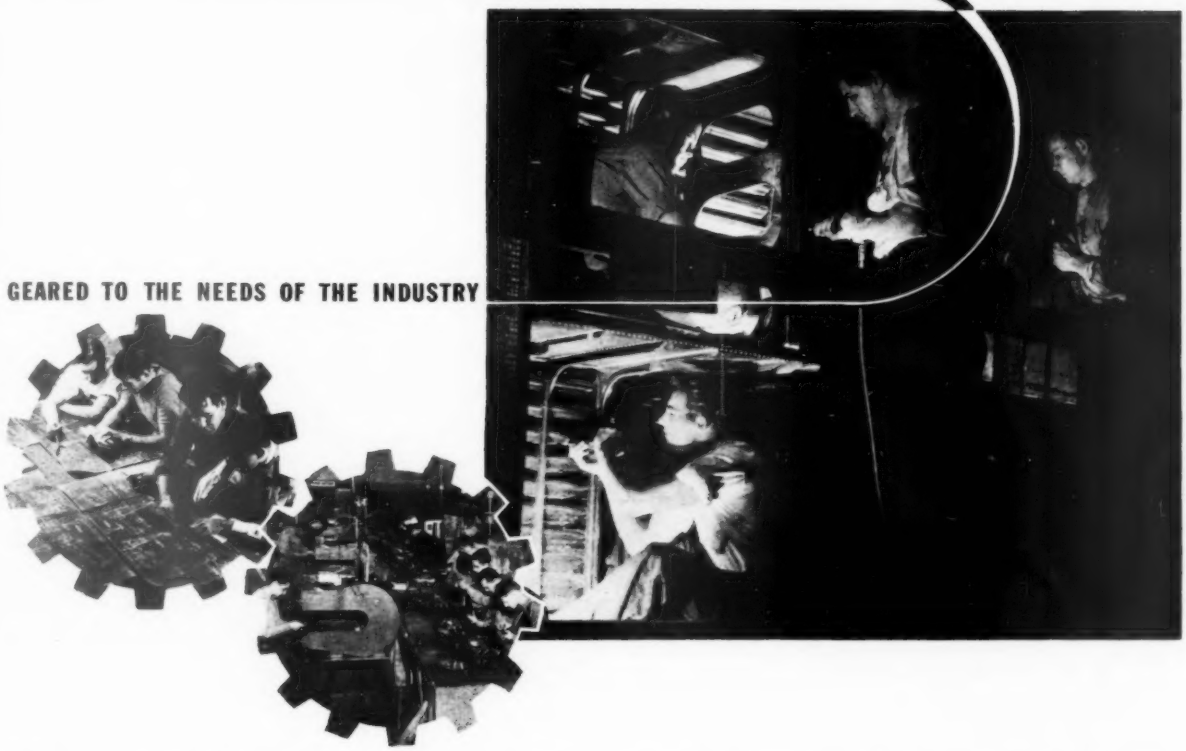

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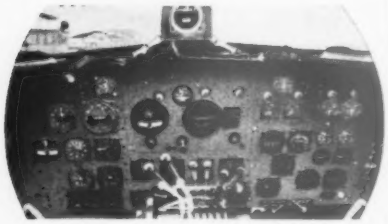

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can fly down to the beach, stake out while he takes a swim, and fly home. If, as a military pilot who has flown it says, you're on cross-country and want to drop down and take a look at Farmer Brown's pigs, you can go ahead and drop. If you have any sort of engine trouble, you can always set it down in the pig pen without much difficulty.

Weick may not be as well-known as some of the men building bombers and pursuit planes, but to the men who encouraged him—including John Geisse, Tom Hardin and C. B. Allen, of the late Air Safety Board; and Bob Hinckley, the Assistant Secretary of Commerce for Air—and to the flyers who have flown his ship, he's a pretty important man who has made a real contribution to flying and probably to the economic life of the nation.

END

Army Cadet Standards

(*Continued from page* 36)

maneuver his plane satisfactorily; when he shows too much nervous tension; when, at any time during the eight months' program, he lags behind the standard pattern for progress. Such failures indicate that he is psychologically unfit for flying or has "an inherent inability to fly."

There are a number of reasons not concerned with the actual operation of planes which may lead to the cadet's dismissal. His failure to accept military discipline, his moral conduct, either past or present, his failure in academic subjects connected with the ground phase of training, the discovery of any misstatements in his application and a good many other reasons which would indicate that it would be "for the good of the service" not to have him in it.

A few months ago 125 ex-flying cadets in Santa Monica, Cal., joined hands in an organization called "We Want Wings." Believing that together they could make their complaints heard farther, they summed up the case for the washed-out pilots in letters and telegrams to their senators, congressmen and the Air Corps Chief of Staff. They admitted to their ranks only those who had been washed-out because of their flying or for some physical reason which might reasonably be waived.

The writer talked to 47 of this group. Only one of them had failed to solo. Four of them had had 100 or more hours instructions. They average 30 hours. Excepting one, they had each been dismissed because of "an inherent inability to fly." The one had been dismissed because 11 years before he had had an automobile accident which knocked him out for two hours. Each of them were within the age limits, had two or more years of academic college work and had successfully passed the physical examination. None of them believed they had received a "raw deal." They each felt they could make good pilots if given a second chance.

Here are the arguments which this group advanced in support of their second chance:

First, the Army already had qualified them and had spent a good sum on their training. One estimated that at least $12,000 had been spent on him. Wasn't it, then, cheaper to salvage a part of this investment than to begin all over again with completely green material?

Second, they had a much better chance of making good the second time than brand-new recruits because they knew now what it was all about. They supported this belief by pointing out that flying cadets who enter the Air Corps program with previous flying experience "sail right through without a hitch." Two had been members of a class of 34 who entered primary training together; 18 were washed-out by the end of the third month. Two more failed later. Of the 14 who finally finished, 12 had had previous flight training. The 20 who failed were all raw in the beginning.

Third, because of this previous experience, they had had their psychological settling period and were capable of becoming better pilots quicker. They believed that much of their "lack of progress" had been due to the sudden combination of a new type of living, the heavy ground training program of new subjects, the instant change from a free and easy academic life to rigid military regimentation, coupled with their first flying experiences were too much.

Fourth, they refused to believe that they had "an inherent inability to fly." They admitted that some people will always fly better than others and that possibly they were not the super-best. Nevertheless they pointed out that they had each been approached by a foreign government to fly military planes as soon as they had been washed-out; that most of them were continuing their training privately or under the CAB, that they *were* flying. They admitted that possibly it would take them longer to become expert pilots but they had the same potentialities as any other.

Fifth, while admitting any shortcomings on their part, they believed that the Army's program of forcing each man into the same progress pattern was a mistake. The fact that about 50 per cent fail to make the prescribed progress and had been failing since the beginning of the Air Corps, indicated that some flexibility was needed if the Army were to ever produce great numbers of pilots.

Sixth, the Army's program was designed to produce an expert pilot in all military branches—combat, scouting, bombing, patrolling, everything. If they could not be trained for highly skilled front-line service, if they were psychologically unfit for this type of flying, why couldn't they be considered for the more common jobs of flying which modern warfare demands of the airplane? Transport flying, home guard work, inactive patrols, local jobs where they did not need to know everything in the book. Why couldn't they be trained for these jobs and let the pilots who were expert be released from them for fighting duty?

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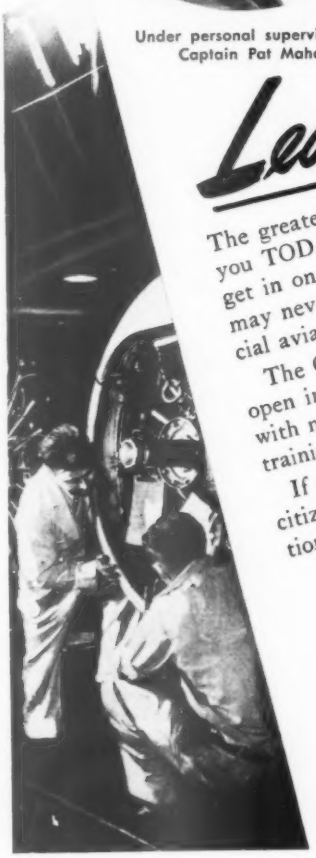

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of the Air Corps and at the same time they had constructive suggestions to offer. First, they believed that the academic ground training should be separated more from the flight training. They believed that a longer period of adjustment to military life and grounding in the classroom work should be given before pushing them into the flight training. Or else the flight training should be given up to the solo point *before* the classroom work was commenced. They believed that when a cadet began his first flight training he should be relieved of all other matters until he has passed over that first period of nervous tension.

Too, they thought that progress schedules should be made to fit the cadet, with reasonableness, instead of trying to make the cadet fit the progress chart. In other words why not attempt to train the cadet instead of seeing whether or not he was as good and fast as the fellow next to him. Flying was an individual matter anyway and flight instructions were necessarily personal.

Several suggested that when a cadet missed his check he should not be then and there washed-out once and for all times. Why not furlough him for 30, 60 or 90 days and give him an opportunity to settle psychologically? They were very strong on this point since they each could sense the difference in their own approach to flying now and when they first went up. It was more economical and reasonable, they thought, to spend an extra month or two with a cadet who had already qualified and gone part of the way than to wash him out and start all over again with another one who had a 50-50 chance of falling over the same hurdles he stumbled on.

If, they point out, a cadet is trained four or five months at a cost of $8,000 or $10,000 and he is washed-out and a new one run in, it actually takes 12 or 13 months to get one finished pilot. Why not take a little longer, if necessary, with the first one and finish him off in a total time of nine or 10 months?

Probably the strongest point which these washed-out pilots had to make was this: they each wanted to fly more than anything else in the world. There is no military job in which a *desire* is more fundamental to ultimate success than in being a pilot. A man might not want to be a soldier and still be made into a fairly good one. A machine gunner might not want to be one but fire with deadly accuracy when the time arrived. Almost any other job in the Army might be handled with a fair measure of success by a man who did not necessarily *want* to do it. But a man can never be a pilot *unless he wants to be one.*

No military rules can ever force a man into being a flyer. The Army must get its men from the ranks of those who *want* to be pilots. Since this desire is primarily the basis of a pilot, certainly all those who want should be carefully handled. In no job is the mere desire sufficient. And in no job is the performance more exacting than in flying. It takes a level-headed man to be a military flyer. And it takes a level-headed training program to prepare him for it.

END

Dead Reckoning

(*Continued from page 44*)

Where T = 4 hrs. + 15 min. safety margin, 4 hrs. or $R = \frac{4\,(106 \times 72)}{(106 + 72)} =$ 171.4 mi. distance out before turning back.

A problem involving radius of action with a moving base or alternate airport is somewhat more involved and may be solved either largely graphically or arithmetically. The solution is more easily grasped when it is traced through graphically so we will proceed with type solutions in this manner and finally check the answers arithmetically.

Because in non-military use the consideration of moving base is so aptly applied to alternate airport problems, the solution will here be considered as an alternate airport problem. (This is essentially the problem faced by our airline and instrument pilots.)

The problem is this: A pilot is planning a flight from one point to a definite destination. Under instrument flight rules an alternate airport must be designated. He also must comply with regulations involving arriving at the alternate airport if so ordered with 45 minutes of fuel remaining. He must therefore compute how far toward his original destination he may fly before having to turn toward the alternate in the event that it develops that he cannot get into his original destination.

To master this problem and make a practical most easily handled solution, it is best to break it down into a series of steps (Figure 3). Also it must be noted that while our fundamental formula does not change certain of its values assume different character.

Thus does R become distance from departure before turning toward alternate airport, t_1 = flying time before turning, t_2 = flying time from turning point in to alternate airport. S_1 = rate of departure, S_2 = rate of return. In understanding the values S_1 and S_2 it is necessary to understand the application of the "moving base." In the solution the point of departure must be considered to be moving along the line from its original location to the alternate airport at a rate equal to the distance between those two points divided by the total flying time. The rate of departure then is the rate that the plane is departing from this "moving air-

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port" along a line between the two at positions determined by equivalent intervals of time (No. 3, Figure 3). This is called the line of relative movement. The rate of return is determined by extending this line until it intersects the air speed circle, being then the rate between this point of intersection and the first hourly position of the "moving base" (No. 4, Figure 3).

No. 1—Lay out the problem to scale, showing points of departure, destination and alternate destination "A." (Wind is obtained.)

No. 2—Determine heading to fly toward destination and ground speed along this original track with given wind.

No. 3—Locate plane and moving base, "departure" at the end of one hour. The position of departure is scaled to its theoretical speed based on the distance to alternate airport and total flying time adjusted for fuel allowance. Connect these two points by "line of relative movement." Extend this through "departure."

With air speed as radius and end of wind arrow as center, swing air speed circle until it intersects the line of relative movement. The final heading into alternate airport is here found by connecting this point of intersection back to the head of the wind arrow. Likewise the track and ground speed are found by drawing a line back to th origin of the wind arrow. (It will be noted that here the plane and departure have moved on a short distance beyond their first hourly position. This demonstrates the constant change of the line of relative movement.)

No. 5—The true position of the track is plotted through alternate airport A. It intersects the original course and determines the point of turning. The air speed triangle is plotted in here to clarify this step although it is not necessary to the problem. The alternate airport now becomes the destination. Note also, the position of the relative movement line.

No. 6—The plane continues on this new course into the alternate airport arriving theoretically at the same time as the moving base "departure" whose speed was based on the original distance to A and the total flying time with fuel allowance made.

The graphical solution is thus seen in six distinct steps. The explanation is misleading only in that it makes the problem seem longer than when actually plotted. A little practice in working two or three with actual values will serve to clarify and promote speed and confidence.

Following is presented a complete, "full dress" solution (Figure 4) with actual values assumed, where in the graphical solution may be seen to check by formula:

Problem: The plane desires to fly from point A to point C, course 50°, distance 350 miles. Designating C as alternate airport 140 miles, bearing 180° from B. Fuel supply is 4 hours, 15 minutes. Allowing 15 minutes' safety margin, how far can the plane fly toward B before he must turn off to C and effect a safe landing? Wind is west, 30 m.p.h. Cruising air speed, 90 m.p.h.

Check this solution by formula which now becomes, for a moving base,

$$t_1 = \frac{T \times S_2}{S_1 \times S_2},\ t_2 = \frac{T \times S_1}{S_1 \times S_2}.$$

It may be seen from the figure that the rate of departure S_1 was determined as 53 m.p.h. and rate of approach S_2 is 118; total flying time = four hours.

Substituting then in $t_1 = \frac{T \times S_2}{S_1 \times S_2} = \frac{4 \times 118}{171} = 2.76$ hours or R (out) = gs out $\times$ t_1, $= 2.76 \times 111 = 306$ miles, and $t_2 = \frac{T \times S_1}{S_1 \times S_2} = \frac{4 \times 53}{171} = 1.24$ hours, or R (in) = gs in $\times$ $t_2 = 94 \times 1.24 = 116.5$ miles.

The foregoing presentation of radius of action may at first seem to the reader to be laying considerable importance on the solution of a problem that to the average aviator is often done by trial and error. The author, however, is of the sincere belief that such conclusions are often fatal. From knowledge of actual cases it would seem unwise not to make sufficient preparation to meet this phase of navigation. Military and Naval pilots must be conversant with the solution of radius of action and any pilot contemplating military

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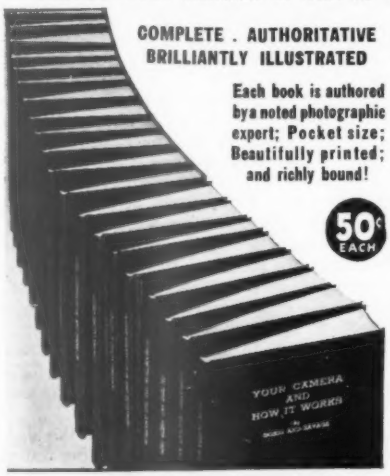
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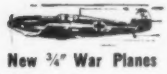

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Dive Bomber

(*Continued from page* 16)

Bombs may be released at around 2,500 feet and, allowing another 1,500 feet to come out of the dive, the pilot has a certain margin of safety. It is possible, of course, to come out of the dive much closer to the surface and, if safe from ground fire, the pilot would be in an admirable position as far as machine gun strafing possibilities are concerned. Anti-aircraft guns protect the heavier ships—at which dive bombing is principally aimed—and the pilot usually figures on pulling up and getting away as fast as possible after releasing his bomb load.

The bomb need not be released at point blank range. As soon as the pilot has his target fixed in the sight, whether he be at 5,000 or 2,500 feet, he can let his lethal cargo loose. A dive-bomber is less troubled by such factors as wind drift, plane velocity and a zig-zagging target than is the horizontal bomber.

Because the dive bomber moves so swiftly in descent, the odds that it will be struck by a shell from anti-aircraft guns of such types as the three-inchers are remote. The altitude or fire-burst for the shells must be adjusted so rapidly to cope with the five or six miles-a-minute drop that only through sheer luck can the operator of this type of gun bag a victim.

But the dive bomber does offer a good target to anti-aircraft machine guns. The plane is literally flying into the barrel along a fixed, steady, decreasing path. The English have found ways to combat the dive bomber with surface fire and our Navy is familiar with their methods. An occasional success against dive bombers does wonders for the morale of gun crews—many of which, in the early days of the current war, were demoralized by the sight and sound of planes charging directly at them from out of the sun.

In the early days of dive bombing, more than one flyer lost his life because the plane he was diving could not stand the strain and flew to pieces in the air. But planes are built for the job now and accidents to dive bombers—as in all other types of aircraft—are caused more by human error than by mechanical defects.

After starting the plunge, the flyer concentrates his full attention on his instruments and on flying the plane. When he nears the target, he must take his eye off the panel and glue it to the bomb sight. Concentrating on the task of keeping the flight on a direct collision course so that his bombs will strike home, he must do the job of flying almost subconsciously.

Sometimes, the pilot's hand will touch the wrong lever or his senses will betray him. For instance, a pilot may be plunging down in a screaming dive, his eye fixed on the target in the sight. With his left hand, he reaches out to release the bomb. But instead of the bomb release, his hand grasps the throttle—and pulls it fully closed. The plane's speed will be suddenly checked and the shot will have been ruined. Before the pilot can gather his wits, he may be plunging to destruction. Or, if he is in a dive-bombing formation, his sudden maneuver may cause a collision with other planes.

Sometimes pilots have found themselves victims of a strange sort of hypnosis. They keep their eyes fixed on the target for so long that they get dangerously close to the surface before they can shake off the fascination.

The stress on a plane is terrific and on rare occasions there have been failures. A pilot once was struck on the head by the cowling, which had given way under the pressure of the steep dive. And give credit to the man who rides the rear seat of a dive bomber—because by the time the pilot finds that he is going to crash, it is too late to warn the passenger.

Each pilot in the squadron groups has implicit faith in the perfect performance of the men about him, for on the foundation of confidence in one's self and in one's mates does formation flying rest. One false move causes chaos. But, attacking in tight, long-rehearsed formations, the Navy's dive bombers have so coordinated their activities that they have repeatedly struck paralyzing blows at the fleet in mock wars.

In these attacks, timing must be perfect. Often, dive bombing is coordinated with attacks by bombers flying horizontally. In sessions where this attack has been practiced, flyers have had occasion to learn the importance of split-second precision. The two types of bomber planes will start out together. When they reach the target areas, the dive bombers will watch their stop watches, peel off at exactly the right moment and plunge down with their loads. The horizontal bombers, flying out of sight above, will also act by the stop watches. When a pre-determined amount of time has passed, they will release their loads.

Dive bombers sometimes are able to operate in adverse weather which would be disadvantageous in the extreme to other bombers. The dive bombers can use spotty weather to good advantage by hiding in the mantle of clouds and darting suddenly toward its target through holes in the overcast. This kind of bombing does not require, as most believe, a plunge straight to earth from great heights. You can safely begin a dive at any altitude down to 7,000 feet. And, rather than a nearly straight dive, it is often more practical to enter a shallow, diagonal dive. Members of one squadron may make their dives at a single objective from different angles, ranging from steep to shallow plunges. Thus, the planes are dispersed, making it difficult for anti-aircraft gunners to concentrate.

As important as the angle of the dive is the delicate technique of pulling out of it. The Navy discourages the sort of dashing bravado that impels a pilot to drop dangerously close to the surface, then sharply stop the headlong descent and try a quick pull out. A man's body can take only a certain amount of punishment and the most critical moment of the dive—the moment when the organs are subjected to the greatest strain—is in

the transfer from the descent to horizontal flight. There is every reason to make sure that the pilot learns to pull out gradually, thus minimizing the strain.

The proficiency which the Navy has developed in the dive bombing technique may be attributed to the years of experience the service has had in the field. World War pilots got some idea of the possibilities of dive bombing and, after the war, some of them began to agitate for experimentation in this line. About 1924, Admiral William A. Moffett, then chief of the Bureau of Aeronautics, allowed some of his men to begin tests. Lieut. W. S. Dillon is credited with conducting experiments at Hampton Roads, Va., which convinced authorities that dive bombing had possibilities.

At the National Air Races in Cleveland, some years ago, a demonstration of the dive bombing technique was given and attracted the attention of foreign observers. Some say that Ernst Udet, the German ace, was present and witnessed the demonstration — remembering it years later when he was called upon to help build the Nazi air force. Others say that movies made at the time were incorporated in news reels and shown abroad. At any rate, it was as a result of this demonstration that Italy, France, Germany and England began to study the technique.

The Army has never believed in the effectiveness of steep dive bombing for land operations. It has no ships comparable to the *Stukas* or the Navy's divers. The Army has used instead a type of attack ship which is used at low altitudes for bombing and machine gunning ground troops. At present, the Army is using a fast medium bomber-attack ship which does the *Stuka's* job. This plane operates at altitudes from zero to 8,000 feet. It carries heavy machine gun armament, can be used for horizontal bombing and is especially stressed and equipped for making comparatively shallow dive bombing attacks.

The consternation created by the appearance of stories about the *Stuka* operations has amazed and amused our flying officers. For to the men of the Navy, it is old stuff, just as fundamental a part of battle as are torpedoes.

END

High Babes

(*Continued from page* 31)

of. Passenger agents and traffic clerks will take charge when you leave him at the airport. If you have any special instructions, they will turn the airline upside down, if need be, to carry them out. They will make sure the stewardess or steward understands the child's situation, then put him in care of the flight crew during the trip.

During the months of July and August alone last year, one of the larger airlines sold more than 650 half-fare tickets. No records are available of the number of babies carried not old enough to have tickets, but their number is great enough to cause the airlines to be stocked up with disposable diapers and sheets, baby foods and the like, which are carried in suitcases known to the trade as "baby kits."

A typical kit contains the following: one Bunny safety strap, two Curity bibs, one Dry Down crib sheet, one card of No. 2½ safety pins, one card of Vanity safety pins, 10 large and 10 small Chux diapers, one set of Vanta olive oil powder and satile soap, one set of two Vanta towels and wash cloths, one package of Co-ets, one can each of the following Gerber's baby foods: green beans, carrots, peas, prunes, liver soup and apricot and apple sauce; one can of SMA and Mix Set, one can of Pet milk, one Hemcoware spoon and dish, three Evenflo nursing bottles and one box of Kleenex.

Babies are better travelers than their parents. They don't suffer any of the ill effects from flying that adults sometimes experience. Neither turbulence, which can nauseate a grownup, nor change in altitude, which will bother your ears, will affect your baby or older child. And many parents have found that the gentle motion of airplanes helps lull baby to sleep.

The real beauty of taking baby by air is the swiftness of the passage. Where a train trip from Chicago to New York means a sleepless night for fear of rolling on top of the baby, it is less than four hours by air—one feeding at most. A transcontinental train trip with a young baby is a half-week of drudgery. But you can give junior his bottle before leaving New York, tuck him into an airliner berth and be in Los Angeles for breakfast the next morning, if you

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go by plane.

A man and a woman in Boston had long stalled off their train trip to Pittsburgh to show off the baby to grandmother, because of the mother's reluctance to spending endless hours of the train looking after the infant. She longed to fly, but was held back by fear—fear of crashing and fear of price. When she learned that it cost less to fly than she had anticipated, she took the daring step and made reservations. They left Boston one evening after the six o'clock feeding, had their own dinner in flight and arrived in Pittsburgh a little late for the ten o'clock bottle. The baby didn't mind that, though, because he was asleep. Now she makes the trip regularly every three months.

That sounds like a success story for the airlines, and it is; but any woman who flies with her children will assure you that it is more than that—that it is the answer to the problem of traveling comfortably without the usual trials and complications children bring to long-distance transportation.

Although women are learning how easy it is to travel by air with their children, there are still some illusions to dispel. Even a first trip is not frightening to an impressionable child. There is no fear of falling from aircraft, no matter how great nor how little the height. Higher altitudes will not stimulate your child. Mothers sometimes comment that their children do not get bored on long plane rides as they do on other trips because the altitude has a soothing effect which usually quiets children and banishes the need of finding something for them to do.

For amusement, there is always the ever new panorama of the earth in a new dimension, or cloud closeups. Some planes are equipped with radios for passengers and all have magazines and newspapers. You can play checkers or cards en route and get out at intermediate stops for a stretch or a soda. Or take along a camera for the kids and let them snap pictures. If they get sleepy, the cabin attendant will tilt back the chairs, wrap them in blankets and nobody will say anything if they snore.

Since the variety of food served is limited by a lack of space, airline chefs must confine their meals to wholesome, generally liked foods. They do not serve fried, fancy, or highly seasoned foods. Older children can eat the regular meals placed on the planes. Milk? Plenty of it.

There are a few simple rules to follow. Be sure to mention when making your reservation that you have a baby, or no special provisions will be made to take care of him. Don't take too much baby equipment with you, for you'll run into excess baggage if you do—the free luggage allowance is 40 pounds per person —and that costs from 2c to 75c a pound depending on the length of trip. If you want special food for junior, order it in advance; it'll be too late if you wait until plane time. Unless your son or daughter has a ticket, you must hold him in your lap if the plane is full. However, if there are empty seats the hostess will see that you get one for your infant. Airline personnel do not take tips, so don't offer them and you'll save yourself embarrassment.

The airlines, which make a special point of giving "personalized service," are particularly anxious to please women —who are the chief deterrent to flying. If you have a problem to solve with reference to transporting you and your children, they will be tickled silly to have you call them and set the problem in their laps. You'll get special service and chances are you'll soon be following the lead of the thousands of women now flying and liking it.

END

Range Calculation

(*Continued from page 53*)

of the wings are seldom higher than 12.

Formulas for determining the range given in Section 1 are Breguet's formula (1909), using the log function and Diehl's formula, using the power function of the weight ratio. For ready use of the formulas, two scales for weight ratios are plotted in Section 6.

The gross weight of an airplane can be estimated if the items not constituting the structure are known. The structure includes all units of the outline and all units carrying air loads. The landing gear is included in the weight of the structure. Sum up all weights—such as power plant, pilots, passengers, controls, instruments, flooring, soundproofing, tanks, fuel, equipment and cargo—and multiply by 1.40 to get the gross weight of the plane. The multiplication factor may vary from 1.35 to 1.46; the higher factors are for flying boats.

In Section 7 weights of a few items are given, weights which may be called removable weights. Sixty pounds should be added to each person carried if standard equipments are not itemized.

Examples of two airplanes are given in Section 8 and Section 9. In Section 8, the brake horsepower of the Ryan *Spirit of St. Louis* for various speeds is plotted. The estimated range was 4,000 miles for a fuel capacity of 425 gallons gasoline. The fuel carried was half of its initial gross weight. In Section 9 the range of a large flying boat is estimated with both formulas. One formula gives 2,200 miles and the other 2,000 miles.

Without bombs, a plane may be used for reconnoitering within a radius of activity, which is the distance of the objective. The distance will be in calm air half of the range of the plane. Replacing the fuel with bombs, converting the plane into a bomber, the radius of action will be reduced. The reduction of the bombing range is directly proportional to increase in bomb loads.

In Section 10 a method of estimating the bomb range is applied to a large plane with an initial weight of 24,000 pounds and a final weight of 14,000. A few points of the curves are determined by using a formula in Section 1, assuming the final gross weight and the initial gross weight to be constant, and varying the fuel weights. In the example, the fuel weights were 2,000, 4,000 and 6,000 pounds. The

results are plotted and the curves drawn. Their intersecting point (1,100 miles) denotes the reconnoitering distance. The bombing range with a 4,000 pound bomb may be solved graphically by marking off the 4,000 pounds between the curves in the pound scales. The distance is found to be 660 miles in calm air.

The bombing range, however, will vary with a head or tail-wind. The navigator must decide on the spot at what speed and altitude the plane should be flown to obtain the maximum range and to be able to return to the base. If the wind speed is known, the most economic flying speed may be determined graphically—as shown in Section 8—by drawing a tangent from a point denoting tailwind or headwind. It is obvious that the loss by a headwind will be greater than the gain by a tailwind. Again the losses are greater when encountering a headwind when flying to the base than when flying to the objective.

Usually charts are prepared for the navigator, showing fuel consumption for wind speeds, altitudes and mixtures in order to eliminate lengthy calculations. Devices are used for estimating the fuel consumption for any atmospheric condition and manifold pressure for engines with superchargers. The maximum range of a heavily loaded airplane, however, depends also on the condition of the take-off runway and on the height of the surrounding trees and buildings. In order to reduce the take-off run, special starting ramps and catapults are installed to shorten the initial acceleration. Refuelling and superimposed planes are also tried to increase the range. Controllable-pitch propellers are standard equipment for long-range planes. High-lift devices are not necessary to reduce the landing speed, because on return to the base the lightened plane will have a satisfactory landing speed.

Investigating the equations used in estimating the range of an airplane, we find that only the weight ratio is used. This indicates that a small airplane should have the same range as a large one. Looking into the matter more closely we find that most variables are in favor of the larger sizes. The landing speed decreases with larger wings, even if the wing loading is the same. The weight of the powerplant per horsepower decreases with more powerful engines; the fuel consumption decreases with increase in power and the weight of the pilot is only a fraction of the gross weight of a large airplane.

Not much information is available on long-range bombers. Using above formulas and assuming that the initial weight of the plane is twice its final weight, the gliding angle to be 15, the fuel consumption to be .45 lbs., and the highest propeller efficiency to be 92 per cent, we find the range to be 7,000 miles with Diehl's formula and 8,000 miles with Breguet's formula, a distance twice from New York to Paris and back. This distance, however, is lower than some airplane manufacturers predicted.

END

Bush Flyers

(*Continued from page 48*)

them under any circumstances. He would handle them on their aerial trip.

Unfortunately, the horses knew nothing about this man. The first animal was determined that he would not be taken aboard. He bucked and kicked on the gang plank and scattered his handlers. He refused to be assured or comforted by the man who knew all about horses. Finally, the big animal was roped and thrown. He was tied fore and aft and the process of getting him aboard began. One of the lashings worked loose so the horse kicked himself free again. Once more he was roped and thrown. He broke away again. The next time he was roped, thrown and tied to a platform. Then he was wrapped in tarpaulin. More rope was added and a willing gang skidded the battling equine aboard.

The horse, however, didn't know when he was licked. He started kicking the wrappings asunder. Two air engineers, not fancying a kicking bee with 5,000 feet of thin air between them and the ground, went into action. They pushed baled hay around the horse. They shoved sacks of feed around his flailing legs. They loaded more 100 lb. sacks of feed on top of them. The horse kicked and kicked. Each time he moved his legs the air engineers jammed more feed down and on top of them until he couldn't move. Rod gave the ship the gun and the first work horse

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in Canadian aviation history was in the air. The other horses were doped. Rod and his men were willing to take long chances in many ways but this wasn't one of them.

Anything goes on northern freights. When the Prospectors Picnic was held at Norway House it was essential that plenty of good beer be on hand. A load of 450 cases of the brew was assembled on the docks and airplanes carried it in to the celebrants. The cost of air transport was forgotten. The beer was the thing.

And it does cost money to transport freight by air, but nothing near what it would cost to take it in by any other means. Aerial freight goes at so much per pound over a certain distance and the costs are based on fuel costs at the district headquarters. Gasoline prices range from 35c to $1.75 per gallon and passenger rates are also subject to fuel costs.

Trappers, however, charter a plane to take their outfits in. In the Fort Reliance district for example, a plane can be chartered to carry a full load of either freight, passengers or both, for about $75 per hour. Trappers on the Upper Thelon will spend about $175 getting their outfits in by air but they save the cost of a canoe and also get three months more time in civilization. If they could not charter a plane they would be compelled to start in mid-August to get to their trapping grounds. They would have to take a new canoe for their freight. When they were ready to come out they would have to leave their grounds in May, when the snow is still on the ground and the ice still on the lakes. They therefore bandon their canoe and bring out their catch by dog team. Even then they do not reach the trading post in time to outfit again and return the same year. But the airplane puts them in to their grounds in less than an hour.

Costs don't matter much in the north. Bush flyers size up the freight and begin to move it. They don't even question the cargoes. Planes were called to Port Radium and when the pilots arrived they were shown their freight.

"Coal!" they exclaimed.

They were correct. Coal—20 tons of it—had to be flown in to Coppermine. The pilots went to work and when the coal was landed at Coppermine it had cost its owners more than $200 per ton.

There's one for Bob Ripley here too. A man came out from Yellowknife by air. He paid $175 for the round trip. He was ready to take the next plane back to Yellowknife. What did he come out for? To get a tooth filled. Who was the man? Dr. Fuller, the Yellowknife dentist.

Canada's Arctic flyers have been responsible for taking many well-known Americans over the bleak, polar regions. The latest party consisted of C. W. Godfrey, prominent St. Louis cosmetic manufacturer. He went out with Alf Caywood and flew over the Great Unknown, an entirely uncharted area of the north country. At Cambridge Bay they picked up Mr. and Mrs. Link Washburn and did a real tour of the north. Mr. Washburn, with photographic and scientific equipment, liked the country so much that he stayed there until Christmas.

So, despite the war, Canada's bush flyers carry on. It has been suggested that they start a patrol to guard Canada's back door against polar invasion. So far nothing has been done about it but the commercial companies have turned their experience and knowledge over to the government and are helping out on the Air Training Scheme by furnishing pilots and equipment for instruction purposes. It is a safe bet that any pilot trained by these hard-boiled veterans will know how to take care of himself when his big day comes.

END

Britain's Aerial Outpost

(*Continued from page 34*)

talked with Maj.-Gen. A. E. Grasett, commander of His Majesty's forces in Hong Kong. He sketched his problem, thwacking a riding-crop against a map of the island and peninsula. Suddenly, although he circumnavigated the fact in the interview, we gathered the truth: he has been ordered to hold Hong Kong at all costs and hazards. Because, since Singapore became the Class A fortress of southeastern Asia, Hong Kong has existed only as a place-to-be-defended for Britain. In the latter's possession, it is a static port, rimmed with potential enemies. Manned by Japan, it would be a serious threat to every white man from Manila to Batavia.

What about aircraft here? Well, there remains China National Airways. We term this the miracle line of the world. Its Douglases still fly between Hong Kong and Chungking, somehow, on a weird schedule arrangement that appears exactly the opposite of United States airline policies. One of our friends left Hong Kong for Generalissimo Chiang's capital that same day last autumn. They telephoned him at 2 a.m. to "stand by."

Outside, the rain drove down; by the wildest imaginative stretch, you couldn't have conceived nastier flying weather. But at 3 a.m. the DC-2 hoisted off the smallish runway on Kowloon Peninsula, spiralled to its 9,000-foot operative altitude over Victoria, then snapped off its running lights. Bee-lining, it streaked for Chungking, radio silent, dark, unarmed except for God's elements which certainly were on its side.

Occasionally the skies clear. That's tough, because CNAC then loses a plane to the Japanese.

You can't base many fighting aircraft on an island only seven miles long. Thus General Grasett's defenses largely are without benefit of pursuits and bombers. Should the Japanese launch their attack, almost certain to come if Britain falls this year, the embattled 12,000 troops at Hong Kong would be forced to sit and take it. Plenty of 4.5-inch anti-aircraft guns and fixed defenses have been prepared. But few planes. That's why the 758-mile Manila-Hong Kong airway looms so important at this juncture.

The former island city stands at the western terminus of the multi-million dollar "stepping stone" project designed to give the United States long range access to its farthest possessions. Upwards of $100,000,000 will be expended on such infinitesimal coral as Canton, Midway, Wake, Howland, Palmyra and Johnston islands. Each will become a snuggery for PBYs or even larger patrolling seaplanes.

Already a contingent of these Consolidated boats has reached the Philip-

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pines. And when you reflect that Cavite Bay lies less than four hours from Hong Kong in a modern bomber, you begin to catch the significance of any possible Anglo-American cooperation in the White Man's East.

END

The Ladies Do the Work

(*Continued from page 39*)

them for the part which they are supposed to cover—ailerons, stabilizer or wing.

She was formerly a designer and dressmaker, but likes aircraft work much better, she says. "I've worked in almost every department of the factory as the first girl to be hired here," she said. "I worked in the wing room and in the dope shop and I even had charge of the production control office at one time, so I got to know the parts of planes pretty well." Working under Mrs. Walter is a pretty young high school graduate, Geraldine Carlson, who is already getting to be expert in putting covers on wings.

The girls also make the rear view windows for the plane out of a heavy celluloid-like material and dope the frames onto the windows. The red and blue leather upholstery is all their handiwork and they even stuff the cushions with pig's hair and cotton, and punch holes in the "hammocks" which are attached to the cushions. They also make the rugs for the floors of the ship, cutting and shaping them to pattern. "An interesting and absolutely worthwhile occupation for women," is the way the sewing girls characterize their jobs. The girls work straight eight-hour days. Their pay ranges from beginners' pay of $2.40 a day up to much higher salaries for the supervisors.

From the window of the factory they can look directly into the windows of the huge Zeppelin dock where parts of army bombers for the Glenn L. Martin Company are being built. Nearby also is the brick factory building where 300 Akron women are busy at "school" learning to make gas masks in the Goodyear gas mask production plant—the only one of its kind in that area. Women have been chosen to do the entire work on these masks, because it is "light, easy" work, so a company spokesman says. A smaller group of Akron women went to a government school in Baltimore, Md., to learn to manufacture these masks, and now are acting as teachers.

END

I Learned About . . .

(*Continued from page 45*)

rope would probably break, but would I have sufficient speed after the zoom to take the shock of the rope hitting the wires even if it did break? I decided not; the prospect of hitting 10 feet from the ground at close to stalling speed was considerably more inviting than plowing in from a hundred feet or so if the other alternative failed. I chose the fence.

I leaned forward, cut the switch and said a prayer. It wasn't a long one, I'll grant you. The plane hit the fence with a grinding and roaring that seemed had the whole world coming down around my ears. I felt the undercarriage shear off as the plane plowed forward. It hit the ground about 25 feet further on and I waited for it to begin to start doing cartwheels and handsprings all over the place. The propeller, I noticed, was holded neatly back at the tips as the plane slithered over the ground and then came to a halt. I tried to stop from shaking and looked back to see what had become of the banner. It was stretched over the fence like a shroud, the tow rope a few feet behind me. Till it had broken off it had served just as a sea anchor does to a ship. There had been enough drag on the tail to keep the plane from rolling up in a ball.

It wasn't until it was all over that I got my real scare. Up to this time I had been too busy to think of anything but how to walk away from this mistake. I sat in the cockpit and wiped the sweat off my face and considered that the damage done was slight enough considering what my foolishness warranted. Never, I resolved, would I ever approach an inanimate object so close that I wouldn't have space to spare in case I had to get over it in a hurry. And then I saw my other mistake that could have easily cost me my life.

The stabilizer adjustment was still in full "up" position where I had wound it on the take-off. Cold sweat ran down my face. I realized what would have happened if the banner would have let

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January 22, 1941

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(Signed) G. B. Drummond"

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MAY ISSUE

FLYING AND POPULAR AVIATION
AT ALL NEWSSTANDS APRIL 10TH!

go as I expected. I would have been in a far worse predicament without realizing it until too late! I would have pulled back on the stick after releasing the banner and expected to hop right up over the wires and I would have been a sadly disappointed young man had I lived to regret it. I would have plowed straight into the phone wires! With the stablizer in that position the plane would have been nose-heavy and, in this particular ship, when it is nose-heavy you have to do considerably more than pull gently back on the stick; when you want to pull a fast climb you have to practically give it a kick in the pants and a hypodermic injection—especially when you consider that all this was happening down-wind!

I got out of the plane and started back toward the field, my knees serenading themselves like two loose bones in a graveyard. Never, I promised myself, would I be so disrespectful of a stablizer in the future.

END

You Don't Say!

(*Continued from page 50*)

week by helping at the field on Sundays and I did some field grading with our tractor; that earned me one hour. I didn't fly from October to January. Then the instructor accepted my helmet and goggles for 45 minutes in a J3L-65 *Cub*. Conditions at home will not permit me to enter college in order to be a flying cadet or to get into a college program. . . . We have a state teachers' college here that has a C.P.T.P. unit. If those boys would have been interested in aviation in the first place, wouldn't they have gone to a school that offered aeronautical courses instead of going to a teachers' school?

Does the Government think guys from the "sticks" couldn't tell a *Spitfire* from a Messerschmitt? . . . Why . . . does the Government teach people to fly who could afford to themselves—if they cared to?

W. M.

Penn Run, Penn.

● All credit to Reader W. M. But many determined young men like himself have the wrong conception of the Civilian Pilot Training Program. The Government isn't training young men to fly free of charge without a purpose. Primarily, C.P.T.P. graduates are considered fledgling material for the Army or Navy flying services. Inasmuch as the latter require that their flying cadets have at least a two-year college education, the most obvious organizations to get air-minded young men into the air are the colleges. —Ed.

From London

Sirs:

. . . I have had several narrow shaves and have seen several dogfights. The area I live in is industrial and has received quite a lot of attention [*the rest of this sentence was censored.—Ed.*]. We have had enough of the *Luftwaffe* and don't wish to hear him again for a long time. So far, I've been blown off my bike by a bomb, knocked into a ditch by another and saw a car, parked by the shelter to which I was hurrying, dissolve into bits. I didn't see much more, being sent flying into someone's front porch.

I can't count the number of air battles. Once I saw a balloon shot down; another time I saw a Junkers hedge-hopping or rather roof-hopping, chased by two *Hurricanes*. They shot it down about a mile away and I have a piece of its engine mount as a souvenir. The vapor trails of the planes engaged in a fight high in the sky were almost common at one time and seemed to attract little attention.

There is a dump not far from here and in it I've noted a Junkers Ju-88, the fuselages of two *Stukas* (Junkers Ju-87), one Heinkel and innumerable odds and ends. There was enough scrap to build a squadron, I should think. . . . Well, I'll stop now, as we're going to be invaded soon and I want to clean my bows and arrows. . . .

P. J. TURNER.

East Acton, W.3,
London, England.

Bouquet

Sirs:

. . . It was a pleasure to work with Ed Churchill in assembling ["Littlest Line," FLYING and POPULAR AVIATION, March, 1941] and, naturally, I was very much pleased with the story. Ed, to me, is an outstanding writer. . . . As a matter of fact, to me your magazine is the most interesting of all the aviation periodicals and I have, for a number of years, looked forward to receiving it. . . .

WALTER L. SEILER,
Vice Pres. and Gen. Mgr.
Catalina Air Transport.

Avalon, Catalina, Cal.

END

Airy Chat

(*Continued from page 4*)

of aircraft as well as pilots—and now is the time to do that setting up.

* * *

CERTAIN aviation experts insist it is absolutely necessary to train military pilots on big, heavy aircraft that get progressively bigger, heavier and faster as the flying cadet advances. We are inclined to question that theory, especially in view of the fact that both Britain's R.A.F. and the German *Luftwaffe* (the latter particularly) started training their pilots on what we would call small sport planes. The Germans especially proved the value of aircraft even as small as gliders. Out of sheer necessity the Germans were forced to start training its air force on gliders—and the results have proved themselves time and again. Yet military experts in the U. S. state flatly that gliders and aircraft with less than 200 h.p. have absolutely no part in the training of our military flyers, despite the fact that the British and Germans always have used trainers with as little as 100 h.p. As to gliders, that phase of aviation has been inexcusably neglected in the United States since the days of the Wrights.

WHAT'S-IN-THE-WIND. Those Eastern Air Lines Douglas DC-2's recently bought by the British are being used as "flying classrooms" by the Royal Australian Air Force . . . Buick has a contract for $36,497,520 worth of Pratt & Whitney aircraft engines for the Army . . . Capt. Kelly Rogers, famed British transatlantic pilot, has been awarded the Order of the British Empire . . . Did anyone notice that Robert Taylor was flying an Army P-35 in "Flight Command," that Hollywood masterpiece that the U. S. Navy was supposed to have checked with magnifying glasses? . . . The Russians have just completed tests on a six-place amphibian monoplane, the SSSR E-59 . . . Those 10-gunned Vultee *Vanguards*, originally ordered for the Swedish air force, will go to the Canadians . . The Junkers company had delivered hundreds of Ju-87's (*Stukas*) to the German air force before they discovered certain dangerous characteristics . . . but the factory was ordered to continue building the bad models so as to train the workmen; necessary changes were made in the next 500 ordered . . . A Swiss aviation magazine for November, 1940, has completed specifications and three-view drawings of the Douglas DC-6—yet to be seen in any American publication . . .

Dick Kirschbaum, the Newark, N. J., aviation editor and FLYING and POPULAR AVIATION correspondent, has had his first song published: "Wings to Victory" (yes, 'tis ASCAP) . . . The original Douglas DC-4, bought by the Japs several years ago, is a "military secret" in Japan . . . German and Italian engineers are known to be in Japan working on the ship and large numbers of spare parts have been ordered for it—indicating, possibly, that the Nipponese are copying the design . . . Royal Australian Air Force pilots are calling themselves RAAFians . . . The BT-13, we're told, must use its flaps on any turn below 120 m.p.h. . . Ten per cent of all Douglas engineers are working on design and development of new types . . . Lockheed has leased a Los Angeles waterfront warehouse to store British and Dutch warplanes awaiting shipment . . . Curtiss-Wright Technical Institute, Glendale, Cal., has a contract to train American volunteer pilots as British instructors and transatlantic ferry pilots . . . Ercoupe expects to build 55 finished planes in May and 60 in June . . . The Navy's new aircraft carriers contracted for are: *Hornet, Essex, Bonne Homme Richard, Kearsarge, Intrepid, Bunker Hill, Cabot, Franklin, Hancock, Orisparry, Randolph* and *Ticonderoga* . . .

LaGuardia Field, New York, averages over 190 incoming and outgoing airline flights daily . . . Martin is delivering one PBM-1 a week to the Navy . . . Piper is testing a four-place *Cub* with a 130 h.p. Franklin engine and a cruising speed of 125 m.p.h. . . The Boeing Airplane Company recently got a contract from the Army for $77,805 worth of aircraft armor plate. . . The Army recently placed a contract for $5,180,100 worth of bomb sights . . . The Link company, manufacturers of the Link Trainer, is building a new aircraft sextant; the R.A.F. and U. S. Navy are interested . . . Aeronca is changing its name from the Aeronautical Corporation of America to Aeronca Aircraft, Inc. . . The Manta fighter mentioned in last month's issue was designed by David R. Davis, inventor of the famed "mystery airfoil" used by Consolidated. . . . It cost Bell $2,123,195.87 for development and experiments on the *Airacobra*, $889,499.48 for the *Airacuda* and $410,-174.88 for the *Airabonita* . . . Bell, incidently, has orders for $60,800,000 worth of *Airacobras* . . .

* * *

HERE'S a worthwhile contest for our readers. Edgar Bergen has put up $175 (first prize, $100; second, $50; third, $25) for the three best rhyming couplets to be postmarked to Edgar Bergen, care of FLYING and POPULAR AVIATION, 608 S. Dearborn St., Chicago, on or before midnight, Tuesday, May 13, 1941. Mr. Bergen is seeking couplets that point a definite, valuable moral to the private flyer. Like:

"With your nose too high
"Not long will you fly."

Or:

"If you land downwind
You'll soon know you've sinned!"

Remember—these are not intended just to be humorous; they must be valuable in helping the private flyer remember basic rules of flying.

* * *

Maybe *we'll* try for the hundred.

MAX KARANT.

END

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G. E. Verhostra, 2010 Hollywood Place, So. Bend, Ind.	Chief '41 Lyc. 65	25 hr.	New	1595
Falcon Aircraft Corp., L. A. Mun. Arpt., Inglewood, Calif.	Chief Cont. 65	240 hr.	No	1550
Sky Harbor, Inc., R.R. No. 11, Box 551, Indianapolis, Ind.	Chief '40 Lyc. 65	400 hr.		1500
Leeward Aviation, New Kensington, Pa.	Chief 1939 Cont. 65	60 hr.	New	1450
Buck Frame, Lovell, Fld., Chattanooga, Tenn.	Tandems Lyc. 65	100 hr.	New	1350
Lane Air Service, Albany, Ga.	Chief Deluxe Cont. 65	375 hr.	Recently	1300
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida	Tandem Trainer Lyc. 65	280 hr.	No	1300
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Trainer(new)Lyc. 65	15 hr.	15 hr.	1300
G. E. Verhostra, 2010 Hollywood Pl., So. Bend, Ind.	Tandem Tr. Lyc. dua. 65	25 hr.	Dem.	1300
C. W. Peterson, Mun. Arpt., Salina, Kansas.	Chief Cont. 65	314 hr.	No	1275
Tred Avon Fly. Serv., Inc., Easton, Md.	Tandem Tr. Lyc. 55	275 hr.	No	1275
G. E. Verhostra, 2010 Hollywood Pl., So. Bend, Ind.	Tandem Tr. Lyc. dual 65	45 hr.	Dem.	1275
Roscoe Turner, Aeronautical Corp., Ind., Ind.	Chief Cont. 65	300 hr.	Top	1275
A. R. Smith, Mun. Arpt., Aberdeen, Miss.	Chief Cont. 50	365 hr.	Nov. 5	1275
Des Moines Fly. Serv., Mun. Arpt., Des Moines, Iowa	Tandem Tr. Cont. 65	125 hr.	New	1200
Edwards Fly. Serv., Flushing Arpt., Flushing, L.I.	Chief Cont. 50	400 hr.	at375hr.	1200
Whicker Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.	T. Frnkln. 60	150 hr.		1200
Lenhart Fly. Serv., Munic. Arpt., Marion, Ind.	Trainer Lyc. 65	65 hr.		1195
Tred Avon Flying Service, Easton, Md.	Tandem Tr. Lyc. 50	85 hr.	No	1175
H. S. Smith 422 S. Union St., Warsaw, Ind.	KC Lyc. 50	567 hr.	Topped	1175
Springfield Avia. Co., Mun. Arpt., Springfield, Ill.	Tandem Tr. Frnkln 60	303 hr.	No	1150
Four Lakes Avia. Corp., Royal Arpt., Madison, Wisc.	LB LeBlond 85	480 hr.	405 hr.	1125
Art Whitaker, Swan Island Arpt., Portland, Oregon	Tandem Tr. Lyc. 65	700 hr.	200 hr.	1075
J. A. Atherton, Rochester Arpt., Rochester, Minn.	Chief Cont. 50	600 hr.	200 hr.	1000
J. A. Atherton, Rochester Arpt., Rochester, Minn.	Trainer Lyc. 65	197 hr.	No	1000
New Mex. Fly. Serv., Box 67, Clovis, N. M.	Tandem Lyc. 65	500 hr.	426 hr.	1000
Lenhart Fly. Serv., Munic. Arpt., Marion, Ind.	Tr. Frnkln. 60	340 hr.	300 hr.	995
Un. Aero. Corp., P.O. Box 222, San Antonio, Texas	Tandem Tr. Lyc. 50	525 hr.	Just	985
Sky Sport, Inc., Cincinnati Arpt., Sharonville, Ohio	Chief Frnkln. 50	700 hr.	550 hr.	975
Un. Aero Corp., P.O. Box 222, San Antonio, Texas	Chief Frnkln. 50	1700 hr.	Just	925
Jones Fly. Serv., Sullivan Av. Arpt., Cols., O.	K Frnkln. 50	680 hr.	Fact. 150 hr.	875
Jenkins Air Serv., Roch. Mun. Arpt., Rochester, N. Y.	Tandem Tr. Frnkln. 60	526 hr.	526 hr.	850
Geo. T. Webb, Oneida, Tenn.	K	300 hr.	Recent	750
J. S. Barham, Airport, Santa Rosa, Calif.	K Aeronca	380 hr.	No	700
Tred Avon Fly. Service, Easton, Md.	KC Cont. 40	680 hr.	Just	650
Oakland Aircraft Corp., Alameda, Cal.	K Aero. 40	730 hr.	Oct. '39	650
Florida Aero & Supply Co., Cannon-Mills Fld. Orlando, Florida	K Aeronca 40	625 hr.	200 hr.	625
Aero-Way's, Inc., Mun. Arpt., Cleveland, O.	K 45 h.p.	328 hr.	298 hr.	600
Aviation Market, LA. Metro Arpt., Van Nuys, Calif.	K Aeronca 40	930 hr.	Yes	575
Lane Air Serv., Albany, Ga.	K Aeronca 43	550 hr.	Recently	550
E.H. Brockenbrough, Mun. Arpt., Charlotte, N.C.	KC Cont.	488 hr.	88 hr.	550
John K. Hinson, Rutherford Arpt., Baltimore, Md.	KC Cont. A 40	350 hr.	14 hr.	595
Leeward Aviation, New Kensington, Pa.	C-3 E113-C 40 h.p.	360 hr.	Yes	545
Oscar L. Hostetter, York Arpt., Thomasville, Pa.	K Aeronca 40	750 hr.	100 hr.	525
Howard G. Noyes, Box 2104, Huntington, W. Va.	Aeronca 40	515 hr.	Recently	485
Red Bank Airport, Inc., Red Bank, N. J.	C3 Aeronca 40	900 hr.	55 hr.	395
ARROW SPORT				
Aero-Ways, Inc., Mun. Arpt., Cleveland, Ohio.	Ford	450 hr.		525
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E. W. Wiggins Arwys., Inc., Providence, R. I.	C-17-B Jacobs 285	600 hr.	Recently	$4800
Colorado Avia. Co., 426 U. S. Nat'l B. B., Denver, Colo.	Jacobs 285	746 hr.	Yes complete	4250
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y.	1935 Jacobs 225	735 hr.	50 hr.	2100
BIRD				
Edwards Fly. Serv., Flushing Arpt., Flushing, L. I.	4 place Kinner 125	60 hr.	Complete	1500
Lane Air Serv., Albany, Georgia	Deluxe Kinner 100 h.p.	900 hr.	Just	1250
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida	Kinner 90h.p.	1500 hr.	250 hr.	795
BUHL				
Pekrul's Fly. Serv., Traverse City Arpt., Mich.	C-A6 Wright 330	1070 hr.	60 hr.	2500
Aero Brokerage Service, Inc., Metro Arpt., Van Nuys, Calif	Pup Szekely 45	624 hr.	48 hr.	575
CESSNA				
Atlantic Avia. Ser., Duport Arpt., Wilmington, Del.	Airmaster Warner 165	257 hr.	New	6250
Northern Okla. Fly. Serv., P.O. Box 556, Blackwell, Okla.	C-36 Warner 145	1310 hr.	63 hr.	2400
DuBois Avia. Assoc., Mun. Arpt., DuBois, Pa.	C-37 Warner 145	501 hr.	45 hr.	2995
Bob Wight, Box 487, Biloxi, Miss.	AW Warner 125	495 hr.	Just relic.	700
L-H Air Serv., Hatboro, Penna.	Warner 125	650 hr.	650 hr.	600
CULVER CADET				
Sky Sport, Inc., Cincinnati Arpt., Sharonville, Ohio	Cont. 75	100 hr.		2000
New Mexico Fly. Serv., Box 67, Clovis, N. M.	Cont. 75	77 hr.		1900
Ellis Eugene Eno, Eno Fly. Serv., Fort Dodge, Iowa	Cadet Cont. 75	29 hr.	Never	1865
CURTISS ROBIN				
Geo. Roper, 27 S. State, Salt Lake City, U.	Challenger	800 hr.	Mar. '40	800
Ralph L. Burton, Alliance Fly. Serv., Mun. Arpt., Alliance, Ohio	Chall. 180	350 hr.	140 hr.	750
A. A. Goldsmith, Nashua, N. H.	Wright J65	700 hr.	150 hr.	700
Foster A. Lane, Port Columbus, Columbus. O.	Robin Challenger 185	850 hr.	35 hr.	650
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	C-1 Chall. 185			600
Fred Kelm, Zap, No. Dakota	Chall. 185	750 hr.	1939	500
H. W. Haver, Lebanon, N. J.	Robin Chall. 185	600 hr.	May	450
DAVIS				
New Mexico Fly. Serv., Box 67, Clovis, N. M.	D-1 LeBlond 60	700 hr.		650
Lane Air Service, Albany, Ga.	LeBlond 65	450 hr.	Recently	500
FAIRCHILD				
Cutter Carr Fly. Serv., P.O. Box 274, Albuquerque, N. Mex.	24 Ranger 175	200 hr.		6350
Atlantic Aviation Serv., Dupont Arpt., Wilmington, Del.	24 Warner 145	357 hr.	New	5950
Carolina Aircraft Sales, Mun. Arpt., Charlotte, N. C.	24 Warner 145	130 hr.	new	5500
Leech Aircraft, Inc., Roosevelt Fld., Mineola, N. Y.	1938 Ranger 165	375 hr.	30 since top	4000
Atlantic Avia. Ser., Dupont Arpt., Wilmington, Del.	24 Warner 145	418 hr.	134 hr.	3950
T. A. Colbertson, Medford, Oregon	246 Warner 145	800 hr.	350 hr.	3500
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	R24 Ranger 145	690 hr.	275 hr.	2900
Cutter Carr Fly. Serv., P. O. Box 274, Albuquerque, N. M.	24 Warner 145	700 hr.	220 hr.	2750
W. Va. Air Serv., Inc., City Arpt., Clarksburg, W. Va.	24 Warner	601 hr.	90 hr.	2750
E. W. Wiggins Airways, Inc., Providence, R. I.	24 Ranger 145	700 hr.	Jan. '40	2500
Inter City Avia., Boston Mun. Arpt., E. Boston, Mass.	24 Warner 145	1200 hr.	150 hr.	2475
John P. Hall, W.Haven Arpt., W.Haven, Conn.	24 Warner 145	360 hr.	recently	1650
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	KR-34 Wright 165	700 hr.	10 hr.	1175

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Calif. Aircraft Corp., P.O. Box 170, Van Nuys, Calif.	22-C-7	Rover 75	1000 hr.	200 hr.	$985
Piedmont Avia., Mun. Arpt., Winston-Salem, N. C.	KR-34	Wright 165	692 hr.	82 hr.	895
FLEET					
Lyn. Air Trans. & Sales, Preston Glenn Arpt., Lynchburg, Va.	7	Kinner B-5 125	1000 hr.	100 hr.	1650
H. A. Hammill, Box 982, Austin, Texas		Warner 125	700 hr.	35 hr.	1500
FRANKLIN SPORT					
H. W. Haver, Lebanon, New Jersey	Sport	Lambert 90	600 hr.	May '40	650
GOLDEN EAGLE					
F. M. Short, W 2208 Grace, Spokane, Wash.	Chief	LeBlond 90	236 hr.	62 hr.	750
GREAT LAKES					
Hudson Valley Aircraft Inc., 60 Dolson Ave., Middletown, N. Y.	American Cirrus Mark III 90 h. p.		320 hr.	Nov. '40	850
Sky Harbor, Inc., R. R. No. 11, Box 551, Indianapolis, Ind.	2TIA	Cirrus 100	650 hr.	Aug. '40	800
KINNER					
Fredericksburg Air Serv., Nottingham Fld., Fredericksburg, Va.	Sportwing	Kinner B5 125 h.p.	915 hr.	265 hr.	1350
Louisville Fly. Serv., Bowman Fld., Louisville, Ky.	Sportster	Kinner 100	466 hr.	c'p't'ly	995
Calif. Aircr. Corp., P.O. Box 170, VanNuys, Calif.	Sportster	Kinner K5,125	1000 hr.	just	985
KITTY HAWK					
Safair, Inc., Roosevelt Field, Mineola, N. Y.		Siemens Halske	675 hr.		550
LUSCOMBE					
Calif. Aircr Corp., P.O. Box 170 VanNuys, Calif.	Phantom	Warner 90	300 hr.	no	2985
Carl Evers, 247 Park Ave., N. Y., N. Y.	Silvaire 75	Cont. 75	Exhibit	ship	2650
Arents Air. Serv., Armonk Village, N. Y.	Silvaire	Cont. 75	500 hr.		2250
Falcon Aircr. Corp., Los Angeles Mun. Arpt., Inglewood, Calif.	8A	Cont. 65	little time	no	2200
Falcon Aircr. Corp., Los Angeles Mun. Airpt., Inglewood, Calif.	8A	Cont. 65		yes	2000
R. C. Davis, 328 N. Adams St., Glendale, Cal.	8A	Cont. 65	135 hr.	none	2000
C. W. Peterson, Salina, Kansas	8A	Cont. 65	60 hr.	none	1995
Midwest Av.Sales,Stinson Arpt.,La Grange,Ill.	8A	Cont. (Injector)	150 hr.	none	1900
Red Bank Arpt., Red Bank, N. J.	8A	Cont. 65	45 hr.	sincenew	1900
Arents Air Serv., Armonk Village, N. Y.	8A	Cont. 65	575 hr.	575 hr.	1850
Arents Air Serv., Armonk Village, N. Y.	8A	Cont. 65	625 hr.	600 hr.	1800
Midwest Avia.Sales,Stinson Arpt.,LaGrange,Ill.	8A-40	Cont. 65	225 hr.	no	1700
Midwest Avia.Sales,Stinson Arpt.,LaGrange,Ill.	8A-40	Cont. 65	175 hr.	none	1700
Jersey Fly. Serv., Oakland, N. J.	8A	Cont. 65	90 hr.	none	1700
Sioux Skyways,Inc.,Mun.Arpt.,Sioux Falls,S.D.	8B	Lyc. 65	250 hr.		1675
J. L. Wells, 106 W. Main, Avon Park, Fla.	8A	Cont. 65	95 hr.	none	1675
Midwest Av.Sales.,Stinson Arpt.,LaGrange,Ill.	8B-40	Lyc. 65	150 hr.	none	1600
Midwest Av. Sales,Stinson Arpt.,LaGrange,Ill.	8B	Lyc. 65	160 hr.	none	1600
Sioux Skyways,Inc.,Mun.Arpt.,Sioux Falls,S.D.	8A	Cont. 65	735 hr.		1550
Midwest Av.Sales,Stinson Arpt.,LaGrange,Ill.	8	Cont. 50	550 hr.	525 hr.	1200
MONOCOACH					
Carnahan Flyg. Serv., Arpt., Bloomington, Ill.		Wright	998 hr.	165 hr.	995
MONOCOUPE					
E. H. Brockenbrough, Mun.Arpt.,Charlotte,N.C.	145	Warner 145	20 hr.	no	5900
St.Louis Fly.Serv.,Lambert Fld.,Robertson, Mo.	DeLuxe	Lambert 90		recently	1950
Robert Belt, Red Oak, Iowa	90-A	Lambert 90	468 hr.	325 hr.	1650
Fla. Aero & Supply Co., Cannon-Mills Fld., Orlando, Fla.		Warner 125	945 hr.	240 hr.	1250
Bennett Air Serv.,P.O.Box 247,Hightstown,N.J.	6-W	Warner-Scarab 125	1290 hr.	74 hr.	1200
Oakland Aircraft Alameda, Cal.		Lambert 90	688 hr.	Feb. '39	850
MOTH					
Carl Evers, 247 Park Avenue, N. Y., N. Y.	Gipsy Major 130		new		2800
NICHOLAS-BEAZLEY					
Ralph L. Burton, Alliance Fly. Serv., Mun. Arpt., Alliance, Nebraska	Model 8	Genet 80	585 hr.	none	500
PIPER CUB					
George C. Haven, Schenectady County Arpt., Schenectady, N. Y.	Cub Cpe.	Cont. 65	20 hr.	no	2000
Stiles Motor Co., 260 Main St., Northport,N.Y.	Coupe J4A	Cont. 65	84 hr.	new	1990
J. A. Field, 17 Forman St., Bradford, Pa.	J-3-C	Cont. 65	40 hr.	no	1900
J. A. Field, 17 Forman St., Bradford, Pa.	J4	Cont. 65	15 hr.	no	1900
Hudson Valley Aircraft Co., 68 Dolson Ave., Middletown, N. Y.	Coupe J4	Cont. 65	40 hr.	Oct. '40	1800
JohnK.Hinson,Rutherford Arpt.,Baltimore, Md.	Coupe '40	Lyc. 65 dual	78 hr.	78 hr.	1768
N. Mex. Fly. Serv., Box 67, Clovis, N. Mex.	Cruiser	Cont. 75	84 hr.	no	1725
Ken's Cub Flyers, Olean Arpt., Olean, N. Y.	Coupe J-4	Cont. 75	115 hr.	no	1700
Gerald W. Richardson, Pt. Erie Arpt., Erie, Pa.	Cruiser J5	Cont. 75	38 hr.	new	1695
Elliott Fly. Serv., Clinton City Arpt., DeWitt, Ia.	J5	Cont. 75	125 hr.		1675
Lynchburg Air Trans. & Sales, Preston Glenn Arpt., Lynchburg, Va.	Coupe 39	Cont. 65	175 hr.	none	1650
John Ruzicka, Circus City Arpt., Peru, Ind.	Cruiser J5	Cont. 75	18 hr.	none	1650
M. F. Warrington,Cub Air Serv.,Selbyville,Del.	Cruiser	Cont. 1A-75	Brand new		1650
Robert Belt, Red Oak, Iowa	J5A	Cont. 75	75 hr.		1650
Elliott Fly. Serv., Clinton City Arpt., DeWitt,Ia.	Cruiser	Cont. 75	140 hr.	none	1650

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Ill.	J-4 '40	Cont. 65	360 hr.	just	$1600
Barr Avia.Corp.,Detroit City Arpt.,Detroit,Mich.	J-4 Cp. '40	Cont. A65	150 hr.	new	1600
L-H Air Serv., Hatboro Arpt., Hatboro, Pa.	J-4	Cont. 65	150 hr.	none	1600
J. A. Field, 17 Forman St., Bradford, Pa.	J-3-C-65	Cont.65 d'l	40 hr.	no	1600
Aero Brokerage Serv., Metro. Arpt., Van Nuys, Calif.	Coupe	Cont. 65	210 hr.		1600
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-4	Cont. 65	100 hr.	new	1595
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	J-4	Cont. 65	383 hr.	353 hr.	1575
McBoyle Cub Sales, Lake Delton Arpt., Lake Delton, Wis.	Cub	Cont. 75	75 hr.	new	1575
Tufts-Edgcumbe Inc., Ravenswood Arpt., Des Plaines, Ill.	J-4	Cont. 65	540 hr.	100 hr.	1550
Jersey Fly. Service, Oakland, N. J.	Cruiser J-5	Cont. 75	135 hr.	none	1550
J. A. Field, 17 Forman St., Bradford, Pa.	J-4 1939	Cont. 65	80 hr.	no	1550
Southern Air Serv., Memphis, Tenn.		Cont. 65	100 hr.	new	1550
Air City Fly. Serv., 5500 E. 3rd St., Dayton, O.		Cont. 75	125 hr.		1545
J. L. Schroeder, Rt. 3, Box 117, Houston, Tex.	J-3	Cont. 65	72 hr.	new	1500
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-5	Cont. 75	100 hr.	new	1500
Safair, Inc., Roosevelt Field, Mineola, N. Y.	Coupe	Cont. 65	290 hr.		1500
McBoyle Cub Sales, Lake Delton Arpt., Lake Delton, Wis.	Cub	Cont. 75	150 hr.	new	1500
Seidner Fly. Serv., S.A.M. Arpt., Youngst'n, O.		Cont. 75	109 hr.	new	1475
Racine Fly. Serv., Racine Arpt., Racine, Wis.	J-4	Lyc. 65	330 hr.	top 320	1475
Bennett Air Serv.,P.O.Box 247,Hightstown,N.J.	Cruiser J5	Cont. 75	206 hr.	20 hr. since fact.maj.	1475
B. F. Hines, P.O. Box 535, Hobbs, N. M.	J-3	Frnklin. 65	51 hr.	no	1468
B. F. Hines, P.O. Box 535, Hobbs, N. M.	J-3	Lyc. 65	112 hr.	no	1468
Des Moines Fly. Serv.,Mun.Arpt.,DesMoines,Ia.	J-5	Cont. 75	50 hr.	new	1450
Lexington Fly. Serv.,Mun. Arpt., Lexington, Ky.	Cruiser	Cont. 75	190 hr.	no	1450
Seidner Fly. Serv., S.A.M.Arpt.,Youngstown,O.		Cont. 65	240 hr.	5 hr.	1450
Hylan Flyg. Serv., Rochester, N. Y.		Cont. 65	450 hr.	25 hr.	1450
Reliable Fly.Serv.,P.O.Box 1303 Bristol,Conn.	J-4	Cont. 65	140 hr.	30 hr.	1400
Orangeburg Fly.Serv.,Box 250,Orangeb.,S.C.	J-3	Lyc. 65	15 hr.	none	1350
Robert Belt, Red Oak, Iowa	J 5A cruiser	Cont. 75	450 hr.		1350
John K. Hinson, Rutherford Arpt., Balt., Md.	'39 Coupe	Cont. 65 dual	283 hr.	5 hr.	1350
Bennett Air Serv.,P.O.Box 247,Hightstown,N.J.	J-4	Cont. 65	163 hr.	just	1325
Leech Aircraft,Inc.,Roosevelt Fld.,Mineola,N.Y.	Coupe	Cont. 65	930 hr.	200 hr.	1300
Southern Arwys. of Danville, Box 205, Danville, Va.	J-3	Cont. 65	385 hr.	never	1275
McBoyle Cub Sales, Lake Delton Arpt., Lake Delton, Wisc.	J3 Spcl.	Lyc. 65D	60 hr.	new	1275
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.	J-4	Cont. 65	330 hr.	100 hr.	1250
Al Gillis Fly. Serv., 125 1st Ave. N., Great Falls, Mont.	J-3	Cont. 65	400 hr.	none	1250
Eddie Braden, Easton Airport, Easton, Pa.	Cruiser	Cont. 75	250 hr.	new mtr.	1250
Desjardin Auto Serv., 24 Fairmount Avenue, Worcester, Mass.	J-3	Lyc. 65	100 hr.	new	1250
Rudy Pekrul, Traverse City Arpt., Michigan.	J-3-L	Lyc. 65	150 hr.		1250
Decatur Avia. Co., 776 S. Maffit St., Decatur, Ill.	J3C	Cont. A-65	220 hr.		1250
W.Va. Air Serv., Box 401, Cnty. Arpt., Clarksburg, W. Va.	Trainer	Lyc. 65	170 hr.		1250
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-4	Cont. 65	550 hr.	400 hr.	1200
Eddie Braden, Easton Airport, Easton, Pa.	J-3	Lycoming	250 hr.	none	1200
M. F. Warrington, Cub Air Serv., Selbyville, Del.	J-3	Cont. A-55	40 hr.	no	1200
Dethloff Fly. Serv., Euclid Ave. Arpt., Willoughby, Ohio	J-3	Franklin 60	200 hr.	top	1195
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Sport Trainer	Cont. A-55	40 hr.	no	1175
Maheux's Arpt., Inc., Stevens Mill Rd., Auburn, Maine	J-2 Seaplane	Cont. 40	346 hr.	25 hr.	1150
Bowman Fly. Serv., Arpt., Keene, N. H.	J3L	Lyc. 50	460 hr.		1150
Va. Cub Dist., Inc., Box 211, Farmv., Va.	Trainer	Lyc. 65	250 hr.		1150
Wm. T. Anderson, P.O. Box 275, Essex Falls, N. J.	J-3	Lyc. 65	205 hr.	yes top	1100
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Trainer J-3	Cont. A-55	35 hr.	checked	1100
Frank Rensma, Youngsville, Box 441, Youngsville, Pa.	J3	Lyc. 65	81 hr.		1100
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Sport	Cont. 55	35 hr.	no	1100
Robert C. Howe, Gardner Arpt., Gardner, Mass.	J-3	Frnklin. 60	165 hr.		1095
B. F. Hines, P.O. Box 535, Hobbs, N. M.	J-3	Frnklin. 55	500 hr.	75 hr.	1090
Somerset Hills Arpt., Basking Ridge, N. J.	J3L	Lyc. 65	225 hr.	no	1090
South. Arwys. of Danville, Box 205, Danville, Va.	J-3	Lyc. 55	570 hr.	never	1075
Oscar L. Hostetter, York Arpt., Thomasville, Pa.	Coupe	Cont. 65	350 hr.	none	1075
Des Moines Fly. Serv., Mun. Arpt., Des Moines, Iowa.	J-3	Lyc. 65	500 hr.	None	1050
Ken's Cub Flyers, Olean Arpt., Olean, N. Y.	J-3	Frnklin. 60 Dual	600 hr.		1050
Hylan Fly. Serv., Rochester Arpt., Rochester, N. Y.	J-3	Cont. 65	775 hr.	9/3/40	1050
Ralph L. Burton, Alliance Fly. Serv., Munic. Arpt., Alliance, Nebraska	J3-F50	Frnklin. 50	200 hr.	200 hr.	1050
Wenatchee Air Serv., Rt. 4, Wena., Wash.	J3	Cont. 50	575 hr.	30 hr.	1050
Ben C. Arquitt, Mun. Arpt., Lima, Ohio	J-3	Frnklin. 60	187 hr.		1025
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	J-3	Frnklin. 60	730 hr.	just	1000
Fayette Airways, Inc., Uniontown, Pa.	J-3	Lyc. 65	450 hr.	12/15/40	1000

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
Somerset Hills Arpt., Basking Ridge, N. J.	J3F Frnkln. 60	650 hr.	no	$990
Ben C. Arquitt, Mun. Arpt., Lima, Ohio	J3 Frnkln. 60	296 hr.	252 hr.	985
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	J-3 Frnkln. 60	1050 hr.	recently	975
Jersey Fly. Serv., Oakland, N. J.	J3 Dual Frnkln. 60	330 hr.	40 hr.	975
J. A. Field, 17 Forman St., Bradford, Pa.	J-3-F-50 Frnkln. 50	465 hr.	yes	975
Ben C. Arquitt, Mun. Arpt., Lima, Ohio	J3 Frnkln. 60	314 hr.	272 hr.	970
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.	J-3 Frnkln. 50	850 hr.	mjr. 750 hrs.	950
Al Gillis Fly. Serv., 125 1st Ave. N., Great Falls, Mont.	J-3 Cont. 50	900 hr.	40 hr.	950
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	J-3 Cont. 50	1100 hr.	50 hr.	950
L-H Air Serv., Hatboro Arpt., Hatboro, Pa.	J-3 Lyc. 55	913 hr.	913 major	950
W. C. Gage, Compton Arpt., Compton, Calif.	J3 Frnkln. 50	1556 hr.	1545 hr.	950
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Late 1939 F-50	700 hr.	660 hr.	925
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Ill.	J-3 Frnkln. 50	475 hr.	never	925
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Late 1939 Lyc. 50	650 hr.	50 hr.	925
Paul D. Eyster, Tri-State Arpt., Angola Ind.	J-3 Frnkln. 60	210 hr.	none	925
W.Va. Air Serv., Box 401, County Arpt., Clarksburg, W.Va.	J3F Frnkln. 50	220 hr.		925
Somerset Hills Arpt., Basking Ridge, N. J.	J3L Lyc. 55	850 hr.	750 hr.	925
L-H Air Serv., Hatboro Airport, Hatboro, Pa.	J-3 Lyc. 50	850 hr.	850 hr.	900
Paul D. Eyster, Tri-State Arpt., Angola, Ind.	J-3 Frnkln. 60	275 hr.	none	900
Decatur Avia. Co.,776 S.Maffit St.,Decatur,Ill.	J3F Frnkln. 50	1020 hr.		900
Southern Air Serv., Memphis, Tenn.	Lyc. 50	300 hr.	new	900
Ellis Eugene Eno, Eno Fly. Serv., Fort Dodge, Ia.	J-3 Frnkln. 60	350 hr.	never	895
John P. Hall, W. Haven Arpt.,W.Haven,Conn.	J-3 Cont. A-50	850 hr.	9/40	895
Gerald W. Richardson, Port Erie Arpt.,Erie,Pa.	J3F Frnkln. 60	300 hr.	200 hr.	895
Gerald W. Richardson, Port Erie Arpt.,Erie,Pa.	J3F Frnkln. 60	675 hr.	no	895
LouisvilleFly. Serv., Bowman Fld., Louisville,Ky.	J3F-60 Frnkln. 60	545 hr.	none	895
LouisvilleFly. Serv., Bowman Fld., Louisville,Ky.	J3-F60 Frnkln. 60	574 hr.	none	895
Somerset Hills Arpt., Basking Ridge, N. J.	J3L Lyc. 50	900 hr.	750 hr.	890
Southern Arwys. Sales Co., Mun. Arpt., Birmingham, Alabama	J-3 Frnkln. 50	450 hr.	425 hr.	875
Ellis Eugene Eno, Eno Fly. Serv., Fort Dodge,Ia.	J-3 Frnkln. 60	650 hr.	never	875
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-3 Lyc. 50	850 hr.	800 hr.	875
The Hudson Valley Airc., 68 Dolson Ave., Middletown, N. Y.	J3 Trainer Frnkln. 50 '40 Piper	400 hr.	9/40	875
Des Moines Fly.Serv.,Mun.Arp.,Des Moines,Ia.	J-3 Frnkln. 60	450 hr.	none	850
Dethloff Fly. Serv, Euclid Ave. Arpt., Willoughby, Ohio	J-3 Frnkln. 50	800 hr.	just maj.	850
Alabama Air Serv, Auburn Arpt., Auburn,Ala.	J-3 Lyc. 55 dual	1160 hr.	962 mj.	850
Alabama Air Serv., Auburn Arpt., Auburn.,Ala.	J-3 Lyc. 55 dual	1224 hr.	maj. 1080 hr.	850
Fayette Arwys., Inc., Uniontown, Penna.	J-3 Frnkln. 55	795 hr.	12/28/40	850
Frank Rensma, Box 441, Youngsville, Pa.	J3 Frnkln. 50	620 hr.	560 hr.	850
John Ruzicka, Circus City Arpt., Peru, Ind.	J3 '39 Frnkln. 50	1400 hr.	250 hr.	850
Paul D. Eyster, Tri-State Airpt., Angola, Ind.	Cub J3 Frnkln. 50	450 hr.	none	850
Sky Sport, Inc., Cincinnati Arpt., Sharonville, O.	J350 Frnkln. 50	436 hr.	will	850
Hylan Fly. Serv., Rochester Arpt., Roch., N. Y.	J-3 Lyc. 50	1050 hr.	Aug. '40	850
Fayette Arwys., Inc., Uniontown, Penna.	J-3 Lyc. 50	815 hr.	12/15/40	800
Bill LePine, Tri-City Arpt., Endicott, N. Y.	Cub J3 Lyc. 50	1400 hr.	1100 hr.	800
L. A. Musgrove, Box 814, Morgantown,W.Va.	J-3 Lyc. 50	800 hr.	400 hr.	795
Susquehanna Air Serv., Montoursville, Pa.	J-3 Lyc. 55	950 hr.	600 hr.	795
Fayette Arwys., Inc., Uniontown, Penna.	J-3 Lyc. 50	900 hr.	12/28/40	785
Howard G. Mayes, Box 2104, Huntington, W. Va.	J-3 Cont. 50	900 hr.		785
Howard G. Mayes, Box 2104, Huntington, W. Va.	J-3 Frnkln. 50	1000 hr.	50 hr.	785
Midwest Aviation Sales, Stinson Airport, La Grange, Ill.	J-3 Lyc. 50	495 hr.	400 hr.	750
Ben C. Arquitt, Munic. Arpt., Lima, Ohio.	Cub J3 '39 Frnkln. 50	678:20	556:15	750
Sky Sport, Inc., Cincinnati Arpt., Sharonville,O.	J350 Frnkln. 50	655 hr.	will 1000 hr.	750
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-3 Lyc. 50	1100 hr.	maj.	745

DEALERS	MODEL AND ENGINE	TIME	OVER-HAULED	PRICE
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	J-2 Cont.	700 hr.	60 hr.	$700
Johnny Haralson, Air Trans. & Sales Co., Toney Field, Pine Bluff, Ark.	Cub J-3 Cont. A-44	650 hr.	600 hr.	695
Woodlawn Balto Co., Baltimore, Md.	J-3 Cont. 40	376 hr.	120 hr.	695
Avia. Market, Los Angeles Metro Arpt., Van Nuys, Calif.	J-2 Cont. 40	810 hr.	yes	675
Dethloff Fly. Serv., Euclid Ave. Arpt., Willoughby, Ohio	1936 Cont. 40	175 hr.	no	675
Edwards Fly. Serv., Flushing Arpt., Flushing,L.I.	Cub J-3 Cont. 40	930 hr.	875 hr.	675
Calkins Arcft.,1022 N. Atlantic, Seattle, Wash.	Cont. 40	800 hr.	17 hr.	675
Oakland Arcft., Alameda, Cal.	J-2 Cont. 40	1785 hr.	May '40	665
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	J-2 Cont. 40	563 hr.	145 hr. justrelic.	650
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	J-2 Cont. 40	650 hr.	100 hr.	650
Utah Pacific Airwys., Inc., Box 1187, Ogden, U.	J3 Cont. 40	1500 hr.	now	650
Calkins Arcft.,1022 N.Atlantic,Seattle,Wash.	Cont. 40	1467 hr.	138 hr.	650
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	J-2 Cont. 40	930 hr.	4 hr.	625
Calkins Arcft.,1022 N. Atlantic,Seattle,Wash.	J-2 Cont. 40	854 hr.	263 hr.	625
Des Moines Fly. Serv., Munic. Arpt., Des Moines, Iowa	J-2 Cont. 40	726 hr.	no time	600
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	J-2 Cont. 40	250 hr.	no	600
Doug Schall, 33 Clagget Rd., Hyattsville, Md.	J-2 Cont. 40	1030 hr.	50 hr.	600
Seidner Fly. Serv.,S.A.M.Airpt.,Youngstown,O.	J-2 Cont. 40	430 hr.	90 hr.	600
J. L. Schroeder, Rt. 3, Box 117, Houston, Tex.	J-3 Cont. 40	850 hr.	10 hr.	600
Wenatchee Air Serv., R.F.D. No. 4, Wenatchee, Wash.	Cub J2 Cont. A40	975 hr.	20 hr. ago	600
Clinton Arpt., Elliott Fly. Serv., DeWitt, Ia.	J-2 Cont. 40	900 hr.	100 hr.	600
Carolina Aircraft Sales, Munic. Arpt., Charlotte, N. C.	J-2 Cont. 40	900 hr.	850 hr.	600
C. W. Peterson, Mun. Arpt., Salina, Kansas	J-2 Cont. 40	1000 hr.	yes	575
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	J-2 Cont. 40	250 hr.		550
Bill LePine, Tri-Cities Arpt., Endicott, N. Y.	Cub J-2 Cont. A-40-5 Dual	900 hr.	800 hr.	525
Krantz Aeronautical Serv., Port Erie, Erie, Pa.	J-2 Cont. A40	350 hr.	75 hr.	525
Louisville Fly. Serv., Inc., Bowman Fld., Louisville, Ky.	J-3 Cont. 40	672 hr.	162 hr.	525
New Mex. Fly. Serv., Box 67, Clovis, N. M.	Cub Trainer Cont. 40 hp.	700 hr.	now	510
Southern Arwys. Sales Co., Mun. Arpt., Birmingham, Ala.	J-2 Cont. 40	700 hr.	675 hr.	500
John Ruzicka, Circus City Arpt., Peru, Ind.	Cub J-2 '37 Cont. 40	310 hr.	10 hr.	500
Krantz Aeronautical Serv., Port Erie, Erie, Pa.	J-2 Cont. A40	650 hr.	150 hr.	500
PITCAIRN				
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	Mailwing Wright J-6-7 245 h.p.	354 hr.	no	1800
PORTERFIELD				
Falcon Arcrft Corp., Los Angeles Mun. Arpt., Inglewood, Calif.	1937 Warner 90	1000 hr.	35 hr.	1250
Speed's Flyg. Serv., Holmes Arpt., Jackson Hts., N. Y.	Cont. 50	105 hr.		1200
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	CP50 Cont. 50	350 hr.	250 hr.	1095
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.	LeBlond 70	485 hr.	90 hr.	850
Inter-City Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.	1938 70	600 hr.		750
Clinch Fly. Serv., Mun. Arpt., North Platte, Nebr.	Zephyr '37 Cont. 40	200 hr.	none	550
REARWIN				
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	Cloudster 3 place Ken-Royce 120	70 hr.		3850
C. Evers, 247 Park Ave., N.Y.C.	Warner 90	138 hr.	none	2250

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- SMOOTHER PERFORMANCE
- INCREASED CLIMB
- FINER APPEARANCE
- GREATER ECONOMY

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The F-B prop is the *only* **adjustable** wood prop made for *light airplanes.* The small additional cost is more than offset by the definite *savings* of fuel, *better* climb and *faster* cruising speed.

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FREEDMAN-BURNHAM ENGINEERING CORPORATION

659 EAST SIXTH STREET CINCINNATI, OHIO

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Cape Aircraft, Inc., Falmouth Arpt., Hatch, Mass.	Sportster	LeBlond 90	340 hr.	newly	$1350
Dawson Air Serv., Box 852, Salina, Kans.	9000L	LeBlond 90 Eng.	235 hr.	20 hr.	1275
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
Four Lakes Avia. Corp., Royal Arpt., Madison, Wis.	7000	LeBlond 70	265 hr.		1050
Utah Pacific Airways, Inc., Box 1187, Ogden, U.		LeBlond 85	1100 hr.	900 hr.	1050
Southern Arwys. of Danville, Box 205, Danville, Va.	1936	LeBlond 85	368 hr.	never	975
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	8500	LeBlond 85	650 hr.	just	950
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	Sportster	LeBlond 70	900 hr.	50 hr.	900
Racine Fly. Serv., Racine Airprt., Racine, Wis.	7000	LeBlond 70	536 hr.	510 hr.	850
ROBIN					
Red Bank Arpt., Red Bank, N. J.		Challenger 185	395 hr.	150 hr.	650
RYAN					
Art Whitaker, Swan Island Arpt., Portland, Ore.	B-5	J6-9-330 h.p.	3500 hr.	125 hr.	1250
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.	B-1	J-5	950 hr.	800 hr.	795
SECURITY					
Aviation Serv. Co., Inc., P.O. Box 32, Hartford, Conn.	S1A	Kinner K-5 100 h.p.	1095 hr.	353 hr.	850
SIKORSKY					
E. W. Wiggins Airways, Inc., Providence, R. I.	S-39	Wasp 450	600 hr.	200 hr.	5500
Carl Evers, 247 Park Ave., N. Y., N. Y.	Amphibian 5 pl	Pratt Whitney Wasp Jr. 300 hp.			3800
Muncie Avia. Corp., Muncie Arpt., Muncie, Ind.	S-39	300 h.p. Pratt-Whitney	465 hr.	55 hr.	3750
SPARTAN					
Aero Brok. Serv., Metro. Arpt., Van Nuys, Cal.	C-3	Wright 175	580 hr.	241 hr.	1000
Spartan Sch. of Aeron., Box 2551, Tulsa, Okla.	C-3	Wright J6-7	981 hr.	245 hr.	900
Spartan Sch. of Aeron., Box 2551, Tulsa, Okla.	C-3	Wright J6-5	1193 hr.	28 hr.	850
Spartan Sch. of Aeron., Box 2551, Tulsa, Okla.	C-3	Wright J6-5	1443 hr.	now	700
SPORTWING					
Oakland Aircraft, Alameda, Calif.		Kinner 125	640 hr.	Jan. '40	2400
STANDARD					
Becher Aircraft Sales, Bettis Fld., R.D., Homestead, Va.	D25	Wright J5	505 hr.	47 hr.	1600
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.		J-5	700 hr.	650 hr.	1195
A. A. Knowles, Rt. 4, Boise, Ia.	New	Wright J 5,220	417 hr.	3-15-40	1000
Pete Grim, R.F.D. No. 4, Staunton, Va.	D31	Kinner B5 125 h.p.		80 hr.	850
Bob Wight, Box 487, Biloxi, Miss.	D-25	J-5-220	1275 hr.	670 hr.	850
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	D-29-A	Kinner 90 h.p.	1524 hr.	75 hr.	750
STINSON					
Neil R. McCray Arpt., Jamestown, N. Y.	SR9F	Wasp 440	725 hr.	475 hr.	10500
Thomas Oakes, 240 Belleville Ave., Bloomfield, N. J.	SR9BD	Lyc. 245	620 hr.	350 hr.	4500
Lynchburg Air Trans. & Sales, Preston Glenn, Lynchburg, Va.	Reliant	Lyc. 245 '36	800 hr.	50 hr.	3850
Leech Aircraft, Inc., Roosevelt Field, Mineola, N. Y.	Reliant	Lyc. 245	950 hr.	150 hr.	3500
Southern Arwys. Sales Co., Munic. Arpt., Birmingham, Ala.	'40-105	Cont. 80	30 hr.	no	3200
George C. Haven, Schenectady City Arpt., Schenectady, N. Y.	105	Cont. 80 Starter	200 hr.	no	3100
Indiana Air Serv., Bendix Fld., So. Bend, Ind.	SR 7C	Lyc. 265	1600 hr.	1500 hr.	3000
Al Gillis Fly. Serv., 125 1st Ave. N., Great Falls, Mont.	SR6 '38	Lyc. 245	538 hr.	150 hr.	2995
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	105 '40	Cont. 80	210 hr.	none	2995
Inter-City Avia., Inc., Boston Munic. Arpt., E. Boston, Mass.	105	Cont. 80	90 hr.		2975
Franklin Rose Aircr., Bay Airdrome, Alameda, Cal.	105	Cont. 80	275 hr.		2950
Pete Grim, R.F.D. No. 4, Staunton, Va.	105 '40	Cont. 80	274 hr.	none	2895
Air Service, Mun. Arpt., Denver, Colo.	105	Cont. 80	240 hr.	40 hr.	2800
J. A. Atherton, Arpt., Rochester, Minn.	105	Cont. 80 hp.	95 hr..	no	2750
Jenkins Air Serv., Inc., Rochester Mun. Arpt., Rochester, N. Y.	105	Cont. 80	185 hr.	top 180	2650
Edwards Fly. Serv., Flush. Arpt., Flushing, L.I.	105	Cont. 80	400 hr.	320 hr.	2600
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	105	Cont. 80	200 hr.		2550
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	SR5-A	Lyc. 245	810 hr.	750 hr.	2495
John K. Hinson, Rutherford Arpt., Balti., Md.	SR6	Lyc. 225	1070 hr.	230 hr.	2395
Safair, Inc., Roosevelt Fld., Mineola, N. Y.	SR-6	Lyc. 225	80 hr.		2200
Colo. Avia. Co., 426 U.S. Nat'l B.B. Denver, Colo.		Cont. 75	265 hr.	Yes	2150
Leech Arcrft., Inc., Roosevelt Field, Mineola, N.Y.	105	Cont. 75	445 hr.	50 since top	2100
Susquehanna Air Serv., Montoursville, Pa.	SR-5	Lyc. 245	920 hr.	650 hr.	2050
Northern Okla. Fly. Serv., P.O. Box 556 Blackwell, Okla.	SR5E	Lyc. 225	950 hr.	350 hr.	2000

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Walter D. Mauk, Municipal Arpt., Blackwell, Okla.	SR 5E	Lyc. 225	950 hr.	engine	$2000
Ellis Eugene Eno, Eno Fly. Serv., Fort Dodge, Ia.	SR6	Lyc. 245	650 hr.	200 bk.	1925
Aero-Way's, Inc., Mun. Arpt., Cleveland, O.	SR 5	Lyc. 325	409 hr.	350 hr.	1850
Franklin Rose Aircr., Bay Airdrome, Alameda, Cal.	SR5C	Lyc. 260	2500 hr.	8 hr.	1800
St. Louis Fly. Serv., Lambert Fld., Robertson, Mo.	JRSR	Lyc. R680 215 h.p.	1065 hr.	recently	1750
Becker Arcrft. Sales, Bettis Field R.D., Homestead, Pa.	SR	Lyc. 215	565 hr.	40 hr.	1600
Moberly Fly. Serv., 605 Concannon St., Moberly, Mo.	1933SR	Lyc. 215	1250 hr.	1200 hr.	1350
Akron Airways, Arpt., Akron, Ohio.	SR	Lyc.	850 hr.	350 hr.	1350
Akron Airways, Arpt., Akron, Ohio.		Lyc. 215	1200 hr.	315 hr.	1300
R. F. Turner, Airport, Spartanburg, S. C.	S	Lyc. 680	800 hr.	150 hr.	1150
Springfield Avia. Co., Mun. Arpt., Springfield Illinois.	SM8A	Lyc. 215	750 hr.	360 hr.	1050
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	S	Lyc. 215	965 hr.	791 hr.	1050
Becker Aircraft Sales, Bettis Field, R.D., Homestead, Pa.	SM8A	Lyc. 215	1035 hr.	just maj.	1000
Dubois Avia. Assoc., Mun. Arpt., DuBois, Pa.	S	Lyc. 215	1023 hr.	285 hr.	995
L. A. Musgrove, Box 814, Morgantown, W.Va.	S	Lyc. 215	1000 hr.	400 hr.	950
Maheux's Airport, Inc., Stevens Mill Rd., Auburn, Maine.	SM8A	Lyc. 215	5441 hr.	226 hr.	950
Tri Cities Avia. Sch., Tri Cities Airpt., Endicott, N. Y.	SM8A	Lyc. 215	1500 hr.	1300 hr.	900
Jesse Jones Mun. Arpt., Lancaster, Penna.	SM8A	Lyc. 225	800 hr.	200 hr.	900
St. Louis Fly. Serv., Lamb. Fld., Robertson, Mo.	SM1F	Wright 330 h.p.	815 hr.	recently	895
Decatur Avia. Co., 776 S. Maffit St., Decatur, Ill.	SM1F	Wright J69 330 h.p.	850 hr.	220 hr.	895
Aero Brokerage Serv., Metro Arpt., Van Nuys, Calif.	SM1	Wright J-5 220 h.p.	1870 hr.	120 hr.	725
Eddie Braden, Easton Airport, Easton, Pa.		Wright	750 hr.	10 hr.	700
Leeward Avia., New Kensington, Pa.	SM-2	Warner 125	550 hr.	yes	500
TAYLORCRAFT					
Walter D. Mauk, Mun. Arpt., Blackwell, Okla.		Cont. 65	19 hr.	new	1950
Avia. Mkt., L.A. Metro Arpt., Van Nuys, Calif.	BL-65	Lyc. 65	38 hr.	new	1875
Dufort Sch. of Aeronautics, Malone, N. Y.	BL-65	Lyc. 65	40 hr.	new	1850
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	DeLuxe	Cont. 65	138 hr.	none	1850
Frantz Fly. Serv., Box 2504, Roanoke, Va.	40	Cont. 65	350 hr.		1800
Springfield Avia. Co., Mun. Arpt., Springfield, Ill.	BC-65	Cont. 65	195 hr.	none	1750
A. J. Moore, 324 State St., Baden, Pa.	B-2	Cont. 65	95 hr.		1750
Franklin Rose Aircrft, Bay Aird, Alameda, Cal.	BC-65	Cont. 65	175 hr.		1750
Hood Aircraft Sales Co., LaFleur Arpt., Northampton, Mass.	BL-65	Lyc. 65	65 hr.	new	1724
Dufort School of Aeron., Malone, N. Y.	BL-65	Lyc. 65	100 hr.	no	1700
Dufort School of Aeron., Malone Arpt., Malone, N. Y.	BC-65	Cont. 65	400 hr.	new	1700
R. A. Snover, Palmyra Arpt., Palmyra, N. J.	BL-65	Lyc. 65	90 hr.	never	1650
Moline Fly. Serv., Mun. Airp., Moline, Ill.	BC-65	Cont. 65	650 hr.		1650
Roscoe Turner Aeron., Indianapolis, Ind.	DeLuxe BC	Cont. 65	305 hr.	top reg.	1650
Washington Pk. Arpt., Homewood, Ill.		Cont. 65	150 hr.	none	1650
Aircraft Unlimited, Inc., Roosevelt Fld., Mineola, N. Y.	BL-65	Lyc. 65	125 hr.		1575
Clinch Fly. Serv., Mun. Arpt., North Platte, Nebr.	BL-65	Lyc. 65 dual	1150 hr.	800 hr.	1550
Moline Fly. Serv., Mun. Arpt., Moline, Ill.	BL-65	Lyc. 65	505 hr.	none	1550
Roch. Aeron. Corp., Roch. Arpt., Roch., N. Y.	BL-65	Lyc. 65	80 hr.		1525
Colo. Avia. Co., 426 U.S. Nat'l B.B., Denver, Colo.	BC-65	Cont. 65 dl.	376 hr.	yes	1500
Inter-City Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.	BC-65	Cont. 65	788 hr.	10 hr.	1500
Bob Howe, Gardner Airp. Gardner, Mass.	BC1940	Cont. 65 hp.	168 hr.		1500
Hubert & Dillon Air. Serv., Inc., Box 177-S, Tacoma, Wash.	39	Cont. 65	450 hr.		1500
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	BL-65	Lyc. 65	80 hr.		1495
Merrill Hale, Hillsgrove, R. I.		Cont. 65	490 hr.		1495
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	BL-65	Lyc. 65	68 hr.	new	1475
Glens Falls Fly. Serv. Airp., Glens Falls, N. Y.	DeLuxe BC	Cont. 65	475 hr.	450 hr.	1475
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	Trainer	Lyc. 65	60 hr.	none	1475
W. B. Jones, Arpt., Marlboro, Mass.		Lyc. 65	262 hr.		1475
Ranger Fly. Serv., Ranger, Texas.	BL-65	Lyc. 65	140 hr.	140 hr.	1450
R. A. Snover, Palmyra Arpt., Palmyra, N. J.	BL-65	Lyc. 65	200 hr.	never	1450
Rochester Aeronautical Corp., Rochester Arpt., Rochester, N. Y.	BL-65	Lyc. 65	470 hr.		1450
Moline Fly. Serv., Mun. Airp., Moline, Ill.	BL-65	Lyc. 65	165 hr.	none	1450
Duane L. Huscher, Box 65, Lawton, Okla.	BC	Cont. 65	1100 hr.	500 hr.	1400
Ranger Fly. Serv., Mun. Arpt., Ranger, Texas	BL-65	Lyc. 65 dual	170 hr.	170 hr.	1395
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	85 hr.	none	1390
Inter-City Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.	BL-50	Lyc. 50	269 hr.		1375
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	104 hr.	none	1375
Ranger Fly. Serv., Ranger, Texas.	BL-55	Lyc.	180 hr.	180 hr.	1350
Walter D. Mauk, Mun. Arpt., Blackwell, Okla.	BLT. 50	Lyc. 50	160 hr.	new Aug.	1350
Marlboro Arpt., Inc., Farm Rd., Marlboro, Mass.		Lyc. 55 dual	452 hr.		1300
Marlboro Arpt., Inc., Farm Rd., Marlboro, Mass.	BL-65	Lyc. 65 dual	372 hr.		1300
Hopewell Fly. Serv., Hopewell Arpt., Hopewell, Va.	BL-65	Lyc. 65	375 hr.	9/40	1300
Northern Okla. Fly. Serv., P. O. Box 556, Blackwell, Okla.		Lyc. 50	275 hr.		1300
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 55	235 hr.	none	1295

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Dufort School of Aeron., Malone Arpt., Malone, N. Y.	BL-55	Lyc. 55	200 hr.	new	$1250
Ryan Air Serv., Decorah, Ia.		Lyc. 50	295 hr.		1250
Clinch Fly. Serv., Mun. Arpt., North Platte, Nebr.	BL-50	Lyc. 50	500 hr.	just	1200
Midwest Avia. Sales, Stinson Arpt., La Grange, Illinois	BL-65	Lyc. 65	560 hr.	400 hr.	1200
R. A. Snover, Palmyra Arpt., Palmyra, N. J.	BL-50	Lyc. 50	350 hr.	just	1200
Avia. Serv. Co., Inc., P.O. Box 32, Hartford, Conn.	BL-65	Lyc. 65	268 hr.		1200
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y.	BL-55	Lyc. 55	500 hr.	none	1200
Howard Fly. Serv., Box 565, Ames, Iowa	BL	Lyc. 65	675 hr.	100 hr.	1200
Ryan Air Service, Decorah, Iowa	BL	Lyc. 50	450 hr.	375 hr.	1200
O'Neal Aircraft Co., O'Neal Airport, Vincennes, Ind		Lyc. 55	450 hr.	No	1200
Dufort Sch. of Aeron., Malone Arpt., Malone, N. Y.	BL-55	Lyc. 55	300 hr.	When new	1175
Bob Howe Gardner Airp., Gardner, Mass.	BL	Lyc. 50 h.p.	44 hr.		1150
Fred Helm, Zap, No. Dakota	B.F.	Frnkln. 50	295 hr.		1150
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	39	Lyc. 50 h.p.	1185 hr.	Nov. '40	1150
Northern Okla. Fly. Serv., P. O. Box 556, Blackwell, Okla.		Frnkln. 50	300 hr.		1100
Dewey Eldred Flying Service, Willoughby, O.	BL-65	Lyc. 65	300 hr.	Just	1100
Phillips Flying Service, Arpt., Mt. Pleasant, Mich.	BL-50	Lyc. 50	800 hr.	650 hr.	1100
Howard Fly. Serv., Box 565, Ames, Iowa	BL	Lyc. 50	800 hr.	Just	1100
Art Whitaker, Swan Island Arpt., Portland, Oregon	BL-50	Lyc. 50	1100 hr.	None	1075
Four Lakes Avia. Corp., Royal Arpt., Madison, Wisc.	BL-65	Lyc. 65	469 hr.	358 hr.	1075
Four Lakes Avia. Corp., Royal Arpt., Madison, Wisc.	BL-50	Lyc. 50	506 hr.		1075
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	BL-50	Lyc. 50	1100 hr.	900 hr.	1050
Oscar L. Hostetter, York Arpt., Thomasville, Pa.	BL-T	Lyc. 50	550 hr.	None	1050
Merrill Hale, Hillsgrove, R. I.		Frnkln. 50	268 hr.	35 hr.	1050
Duane L. Huscher, Box 65, Lawton, Okla.	BF	Frnkln. 50	1200 hr.	100 hr.	1025
Spartan School of Aeron., Box 2551, Tulsa, Okla.	BL-50	Lyc. 50	1397 hr.	159 hr.	1000
Rochester Aeron. Corp., Roch. Arpt., Roch., N. Y.	BL-65	Lyc. 65	1102 hr.	140 hr.	1000
Dewey Eldred Fly. Serv., Willoughby, Ohio	BL-50	Lyc. 50	866 hr.	Just	1000
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Late '39	Lyc. 65	500 hr.	Major No time	1000
Palmetto Air Sch., Mun. Airp., Spartanburg, S. C.	BL	Lyc. 50			1000
Palmetto Air Sch., Mun. Airp., Spartanburg, S. C.	BL	Lyc. 65			1000
Foster A. Lane, Port Columbus, Columbus, O.	BL-50	Lyc. 50		No time since	995
John P. Hall, W. Haven Arpt., W. Haven, Conn.	BL-50	Lyc. 50	400 hr.	New motor	995
Four Lakes Avia. Corp., Royal Airport, Madison, Wisc.	BL-50	Lyc. 50	844 hr.	721 hr.	975
Inter-City Flying Serv., Mun. Arpt., Ft. Wayne, Ind.	BF-50	Frnkln. 50	596 hr.	25 hr.	950
L. A. Musgrove, Box 814, Morgantown, W. Va.	BL-50	Lyc. 50	500 hr.	100 hr.	950
Hood Aircraft Sales Co., LaFleur Arpt., Northampton, Mass.	BL-50	Lyc. 50	875 hr.	10/20/40	950
Hood Aircraft Sales Co., LaFleur Arpt., Northampton, Mass.	BL-50	Lyc. 50	800 hr.	July '40	950
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	'38	Cont. A-40-A	1100 hr.	Nov. '40	895
Jersey Fly. Serv., Oakland, N. J.	BF	Frnkln. 50	800 hr.	None since rebuilt	875
Midwest Avia. Sales, Stinson Arpt., LaGrange, Ill.	BL-50	Lyc. 50	550 hr.	450 hr.	850
Midwest Avia. Sales, Stinson Arpt., LaGrange, Ill.	BL-50	Lyc. 50	550 hr.	450 hr.	850
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	BF-50	Frnkln. 50	512 hr.	Top 392 hr.	850
Dewey Eldred Fly. Serv., Willoughby, Ohio	BF-50	Frnkln. 50	400 hr.	Just	850
Atlantic Avia. Serv., Dupont Arpt., Wilmington, Del.		Frnkln.	1000 hr.	500 hr.	845
Jesse Jones, Mun. Arpt., Lancaster, Pa.	BC	Cont. 50	300 hr.	None	800
Jesse Jones, Mun. Arpt., Lancaster, Pa.	1939	Cont. 50	400 hr.	50 hr.	800
Jennings Bros., No. Grafton, Mass.		Cont. 40	660 hr.	100 hr.	800
Canton Avia. Co., Martin Field, Canton, Ohio	BL-50	Lyc. 50	750 hr.	115 hr.	795
Canton Avia. Co., Martin Field, Canton, Ohio	BL-50	Lyc. 50	725 hr.	125 hr.	795
Canton Avia. Co., Martin Field, Canton, Ohio	BL-50	Lyc. 50	800 hr.	200 hr.	795
Dewey Eldred Fly. Serv., Willoughby, Ohio	BL-50	Lyc. 50	500 hr.	Just	775
Stinson Flyg. Corp., Glendale, Calif.		Cont. 40	1100 hr.	170 hr.	760
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	Mod. A '38	Cont. A-40	900 hr.	140 hr.	750
Dewey Eldred Fly. Serv., Willoughby, Ohio	BL-50	Lyc.	375 hr.	25 hr.	750
Al Gillis Fly. Serv., 125 1st Ave., N. Gt. Falls, Mont.	A	Cont. 40	800 hr.	20 hr.	750
Ryan Air Service, Decorah, Iowa		Cont. 40	326 hr.		750
Orangeburg Fly. Serv., Inc., Box 250, Orangeburg, S. C.	"A"	Cont. 40	500 hr.	100 hr.	750
Reifenberg Avia., Inc., St. Johns, Pa.	Mod. A '38	Cont. A-40-4	275 hr.	25 hr.	750
Orangeburg Fly. Serv., Box 250, Orangeburg, S. C.	"A"	Cont. 40	500 hr.	100 hr.	$725
L. A. Musgrove, Box 814, Fairmont, W. Va.	A	Cont. A-40	400 hr.	50 hr.	700
Clinch Fly. Serv., Mun. Arpt., No. Platte, Nebr.	A	Cont. 40	850 hr.	700 hr.	700
Duane L. Huscher, Box 65, Lawton, Okla.	A	Cont. A40	1000 hr.	700 hr.	700
B. F. Sponamore, 710 5 St., Dodge City, Kans.	Model A	Cont. A40-4	600 hr.		700
A. R. Smith, Mun. Arpt., Aberdeen, Miss.		Cont. 40	750 hr.	Oct. 1st	700
Carnahan Flyg. Serv., Bloomington, Ill.		Cont. 40	507 hr.	100 hr.	700
Merrill Hale, Hillsgrove, R. I.		Cont. 40	1081 hr.	100 hr.	695
Springfield Avia. Co., Mun. Arpt., Sprgfld., Ill.	A	Cont. A-40-4	375 hr.	None	650
Utah Pacific Airways, Inc., Box 1187, Ogden, U.		Cont. 40	1200 hr.	1050 hr.	650
Reifenberg Avia., Inc., St. Johns, Pa.	A1938	Cont. A40-4	450 hr.	22 hr.	650
Whicker Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.		Cont. 40	750 hr.	60 hr.	650
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	1937	Cont. A-40	865 hr.	Now	650
Sky Sport, Inc., Cincinnati Arpt., Sharonville, O.		Cont. 40	975 hr.	800 hr.	650
J. L. Wells, 106 W. Main, Avon Park, Fla.		Cont. 40	690 hr.	100 hr.	650
Jersey Fly. Serv., Oakland, N. J.	A	Cont. A40	595 hr.	None since rebuilt	625
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	Model A	Cont. A-40	340 hr.	Just	550
TRAVELAIR					
Lyn. Air Trans. & Sales Corp., Preston Glenn Arpt., Lynchburg, Va.	4000	Wright J-5 220	1000 hr.	300 hr.	1650
J. S. Barham, Arpt., Santa Rosa, Cal.	12W2002	War-Scarab 125 h.p.	2000 hr.	5-20-40	1450
Aero Brok. Serv., Metro. Arpt., Van Nuys, Calif.	B4000	Wright 175	2613 hr.	86 hr.	1450
Sky Harbor, Inc., R. R. No. 11, Box 55, Indian, Ind.	Speedwing	Wright J65	800 hr.	July '40	1200
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	4000	Wright J-5 220	1590 hr.	110 hr.	1175
N. Idaho Fly. Serv., Weeks Fld., Coeur D'Alene, Idaho	4000	Wright J5-220	1100 hr.	1050 hr.	1100
J. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Texas	4000	Wright J-5 215	847 hr.	150 hr.	1000
Calif. Arcrft. Corp., P.O. Box 170, Van Nuys, Calif.		Hisso	1500 hr.	Just	850
Sky Harbor, Inc., R.R. No. 11, Box 551, Indian, Ind.		Tank 115	78 hr.	ship 7-40	800
Leeward Avia., New Kensington, Pa.		Chall. 185	700 hr.	Yes	745
St. Louis Fly. Serv., Lambert Fld., Robertson, Mo.		Wright Gipsey 90 h.p.	480 hr.	Just	745
St. Louis Fly. Serv., Lambert Fld., Robertson, Mo.		Wright 90	480 hr.	Just ove.	745
Calkins Aircr. Co., 1022 N. Atlantic, Spokane, Wash.		Warner 125	1447 hr.	Plane & Eng. 30 hr. ago	700
VERVILLE					
J. C. Bashioum, 107 N. Gladstone Blvd., Kansas City, Mo.	Air Coach	Wright J6-7	1100 hr.	60 hr.	700
WACO					
Parkersburg Fly. Serv., Arpt., Parkersburg, W. Va.	N	Jacobs 330	100 hr.		6000
Foster A. Lane, Pt. Columbus, Columbus, Ohio	ZKS-7	Jacobs 285	150 hr.		4700
Hawthorne Fly. Serv., Mun. Arpt., Charleston, S. C.	ZPF-6	Jacobs 285	760 hr.	Mar. '39	3500
Muncie Avia. Corp., Muncie Airp., Muncie, Ind.	Custom '36	Wright 285	1150 hr.	No time	3500
Aviation Market, L.A. Metro. Arpt., Van Nuys, Calif.	S-7	Jacobs 225	310 hr.	No	3250
Air Serv., Inc., Mun. Arpt., Denver, Colo.	1935 Cus.	Jacobs 225	950 hr.	No time	3200
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	Cus. Cabin	Jacobs 225	600 hr.	115 hr.	2850
R. Turner Aero Corp., Indianapolis, Ind.		Jacobs 225			2750
Hylan Fly. Serv., Inc., Arpt., Rochester, N. Y.	YOC	Jacobs 225	422 hr.	Apr. '39	2600
E. W. Wiggins Arwys., Inc., Providence, R. I.	C	Wright 285	350 hr.	Recently	2500
Krantz Aeronautical Serv., Pt. Erie, Erie, Pa	C6	Wright 320	650 hr.	200 hr.	2500
Bowman Fly. Serv., Arpt., Keene, N. H.	NKC-S	Cont. 210	550 hr.	145 hr.	2300
Neil R. McCray, Airport, Jamestown, N. Y.	'37 C	Jacobs 225	415 hr.	Never	2250
Avia. Serv. Co., P. O. Box 32, Hartford, Conn.	YOC	Jacobs 225	720 hr.	220 hr.	2250
Inter-City Avia., Inc., Boston Mun. Arpt., E. Boston, Mass.	Cabin	Jacobs L-4 225	845 hr.	213 hr.	2175
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	UBF	Cont. 210	800 hr.	Ship & Engine 8	2150
John P. Hall, W. Haven Arpt., W. Haven, Conn.	F-4	Jacobs 225	705 hr.	20 hr.	2100
J. Ruzuika, Circus City Arpt., Peru, Ind.	Cabin	Jacobs 225	700 hr.	110 hr.	2000
J. L. Wells, 106 W. Main, Avon Park, Fla.	YKC	Jacobs 225	650 hr.	200 hr.	2000
Southern Arwys. of Danville Box 205, Danville, Va.	YKC	Jacobs 225	917 hr.	550 hr.	1850
Bill LePine Tri-Cities Airp., Endicott, N. Y.	UEC	Cont. 210	500 hr.	500 hr.	1500
Red Bank Arpt., Inc., Red Bank, N. J.	Cabin YKC	Jacobs 225	950 hr.	95 hr.	1350
Hawthorne Fly. Serv., Mun. Arpt., Charleston, S. C.	Cabin	Cont. 165	520 hr.	500 hr.	1295
Arents Air Serv., Armonk, N. Y.	OEC	Kinner 210	775 hr.	40 hr.	1275
Foster A. Lane, Port Columbus, Columbus, O.	INF	Kinner B5-125	No time	since	1250
W. P. Snyder, 417 W. Mulberry, Kokomo, Ind.	Taperwing	J5-9-220	650 hr.	200 hr.	1225
Arent Air Serv., Armonk Village, N. Y.	YBC	Kinner 210	825 hr.	750 hr.	1100
W. P. Snyder, Mulberry St., Kokomo, Ind.	Taperwing	Wright		Yes	1100
St. Louis Fly. Serv., Lambert Fld., Rob., Mo.	F	War-scarab	1158 hr.	Recently	1100
J. F. Barham, Airprt., Santa Rosa, Cal.	RNF	Warner 125	1800 hr.	280 hr.	1095
Southern Air Serv., Memphis, Tenn.		Warner 125	1000 hr.	Recently	1050
Avia. Serv. Co., P.O. Box 32, Hartford, Conn.	QDC	Cont. 165	1063 hr.	203 hr.	1000
Aero Serv., Inc., McKinley Arpt., Canton, Ohio.	Str.-Wing	Wright J-5	800 hr.	50 hr	950
J. Jones, Mun. Arpt., Lancaster, Pa.	F	Kinner 125	1200 hr.	50 hr.	900
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	Tpr.wing	Wright 250-J6	528 hr.	25 hr.	850

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PILOTS and fighting planes of the 20th Pursuit Group of the Army Air Corps recently lined up at Hamilton Field, Cal., to honor Staff Sergeant Lyndon B. Van Hook who was decorated with the Soldier's Medal, the Army's highest award for heroism in peacetime. Sergeant Van Hook was decorated for bravery displayed on April 13, 1938, at Barksdale Field, Shreveport, La. On that day Van Hook noticed that a twin-engined Keystone bomber, minus its crew, was running in circles on the ground with its right engine running wide open. Noting other men, gasoline tank cars and other airplanes all near the careening bomber, Van Hook raced across dangerously muddy ground and, at the risk of his life, swung himself up onto the big ship, climbed to the cockpit and closed the throttle, bringing the plane to a stop.

British Fly On

DESPITE the fact that Great Britain has been at war for more than a year, the route miles being flown today by British civil aircraft are 94 per cent of what they were in peace time.

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P A April, 1941

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By Myron F. Eddy

Lieut., U. S. Navy, Retired; formerly Instructor in Aircraft Radio at Naval and Commercial Ground Schools

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